SOIL SURVEY

Cocke County Tennessee

Series 1944, No. 4

Issued March 1955

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with the
TENNESSEE AGRICULTURAL EXPERIMENT STATION
and the
TENNESSEE VALLEY AUTHORITY

How to Use THE SOIL SURVEY REPORT

FARMERS who have worked with their soils for a long time know about the soil differences on their farms, perhaps also on the farms of their immediate neighbors. What they do not know, unless soil surveys have been made, is how nearly their soils are like those on experiment stations or on other farms, either in their State or other States, where farmers have gained experience with new or different farming practices or farm enterprises. They do not know whether higher yields obtained by farmers in other parts of their county and State are from soils like theirs or from soils so different that they could not hope to get yields as high, even if they followed the same practices. One way for farmers to do away with some of the risk and uncertainty involved in trying new production methods and new varieties of plants is to learn what kinds of soils they have so that they can compare them with the soils on which new developments have proved successful.

SOILS OF A PARTICULAR FARM

To find what soils are on any farm or other land, it is necessary first to locate this land on the map that accompanies this report. This is easily done by finding the township in which the farm is located and by using landmarks such as roads, streams, villages, dwellings, and other features to locate the boundaries.

Each kind of soil mapped within the farm or tract is marked on the map with a symbol. For example, all the areas marked Dy are Dunmore silty clay loam, eroded rolling phase. The color in which the soil area is shown on the map will be the same as the color indicated on the legend for the particular type of soil. If you want information on this Dunmore soil, turn to the section in this publication on Soil Types and Phases and find Dunmore silty clay loam, eroded rolling phase. Under this heading you will find a statement of what the characteristics of this soil are, what it is mainly used for, and some of the uses to which it is suited.

Suppose, for instance, you wish to know how productive Dunmore silty clay loam, eroded rolling phase, is? You will find it listed in the left-hand column of table 15. Opposite the name you can read the yields for different crops grown on the soil. This table also gives estimated yields for all the other soils mapped in the county.

If, in addition, you wish to know what use and management practices are effective on Dunmore silty clay loam, eroded rolling phase, read what is said about this in the section headed Use and Management of Soils, where the soils suited to the same uses and management practices are grouped together.

SOILS OF THE COUNTY AS A WHOLE

A general idea of the soils of the county is given in the section on The Soils of Cocke County, Their Use and Management, which tells about the principal kinds of soils, where they are found, and how they are related to one another. After reading this section, study the soil map and notice how the different kinds of soils tend to be arranged in different parts of the county. These patterns are likely to be associated with well-recognized differences in types of farming, land use, and land use problems.

A newcomer to the county, especially if he considers buying a farm, will want to know about the climate; the types and sizes of farms; the principal farm products; the kinds of farm tenure; availability of roads, railroads, and electric services; water supplies; industries of the county; and population. Information about all these will be found in the sections on General Nature of the Area and on Agriculture.

Those interested in how the soils of the county were formed and how they are related to the great soil groups of the world should read the section on Morphology and Genesis of Soils.

This publication of the soil survey of Cocke County, Tenn., is a cooperative contribution from the—

SOIL CONSERVATION SERVICE
the
TENNESSEE AGRICULTURAL EXPERIMENT STATION
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SOIL SURVEY OF COCKE COUNTY, TENNESSEE[1]

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United States Department of Agriculture in cooperation with the Tennessee Agricultural Experiment Station and the Tennessee Valley Authority

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[1] Field work for this survey was done while Soil Survey was a part of the Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration.

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COCKE COUNTY is predominantly an agricultural and forest area. Practically all of the county originally supported a good forest cover. About 42 percent of it has been cleared for crops and pasture, and most of the rest has been cut over at least once. Forest products are an important source of income, and most farms contain some woodland. About one-third of the forest is Government-owned. Most of the forest land is too steep and stony for other use, but some areas may be regarded as potential grazing land. Corn, wheat, and hay are the chief field crops; tobacco is the principal cash crop. Vegetables such as beans and cabbage and fruits such as apples, peaches, and cherries are grown and are well suited to some soils. Dairying and poultry raising are well suited to much of the land. Dairying, especially, has gained increasing attention in recent years. The average grazing season in the county is about 290 days, and it may be longer where winter cover crops are grown. To provide a basis for the best uses of the land, this soil survey was made by the United States Department of Agriculture, the Tennessee Agricultural Experiment Station, and the Tennessee Valley Authority. Field work was completed in 1944, and, unless otherwise specifically indicated, all statements in this report refer to conditions in the county at that time.

GENERAL NATURE OF THE AREA

LOCATION AND EXTENT

Cocke County is in the eastern part of Tennessee adjacent to and partly within the Great Smoky Mountains National Park (fig. 1).

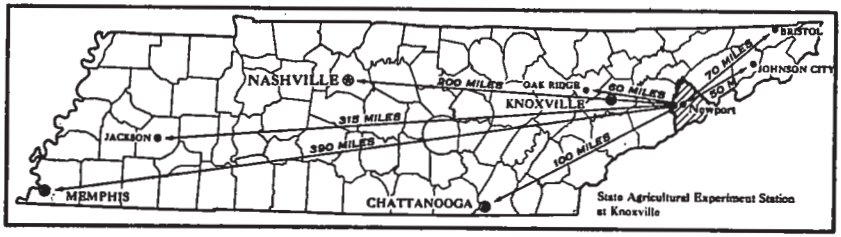

FIGURE 1.—Location of Cocke County in Tennessee.

The southern and southeastern boundaries coincide with the Tennessee-North Carolina State line. Newport, east of Knoxville, is the county seat and largest town. The total area of the county is 434 square miles, or 277,760 acres. Of this, a total of about 3,871 acres is occupied by the Douglas Reservoir.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

PHYSIOGRAPHY

Approximately the southeastern one-third of the county is in the Blue Ridge physiographic province, and the rest is in the Ridge and Valley province commonly known as the Great Valley of East Tennessee (*4*).[2] The Blue Ridge province includes a heterogenous arrangement of high rugged peaks and ridges of the Appalachian Mountain region that extends southwestward across the extreme eastern and southeastern parts of Tennessee. Part of the province in Cocke County is in the Great Smoky Mountains, which are in the Appalachian chain, and the rest includes mountainous outliers and foothills adjacent to the Smokies.

The Ridge and Valley province represents a belt of uneven lowland 30 to 50 miles wide that extends in a northeast-southwest direction across east Tennessee adjacent to and parallel to the Blue Ridge province. It slopes gradually southwestward. It is characterized by a series of alternating parallel ridges and valleys that extend in a northeast-southwest direction, or lengthwise of the province and parallel with the strike of the underlying folded and faulted bedrock strata. Approximately the northwest two-thirds of Cocke County is within this province. Both relief and drainage are more variable than in the Blue Ridge province, but the ridges are lower and more uniform in elevation and less rugged than those of the mountains.

The principal rocks underlying the Ridge and Valley part of the county are shale and limestone. Slate, quartzite, and conglomerate dominate the Blue Ridge section or mountainous part, and granite, gneiss, and schist occur over a comparatively small part of the area along the Tennessee-North Carolina State line.

[2] Italic numbers in parentheses refer to Literature Cited, p. 171.

All of the rocks have been subjected to severe folding and faulting, and this with the subsequent differential geologic erosion of the rocks has produced the present relief. The Ridge and Valley part is dominantly rolling to hilly, whereas the Blue Ridge section is mostly steep and mountainous. Parts of the valley area are steep, however, but these steep slopes are relatively short. Smooth areas, nearly level and undulating, are confined to the bottom lands, stream terraces, small tracts on the broader ridge tops of the uplands, and parts of the colluvial slopes.

LOCAL PHYSIOGRAPHIC DIVISIONS

From a more local physiographic aspect, the county can be divided into four fairly distinct physiographic subdivisions: (1) The knobs, (2) the valley land, (3) the foothills, and (4) the mountains. Each of these subdivisions is characterized by a distinct type of relief that has been determined largely by the character of the dominant underlying rock and the resistance of that rock to weathering over a long geologic period. The first two subdivisions are within the Ridge and Valley part of the county, and the latter two are in the Blue Ridge section.

The knobs.—This subdivision is underlain almost wholly by shale, much of which is calcareous. The surface is hilly to steeply sloping. This area is chiefly in the extreme northern part of the county and occupies about half of the Ridge and Valley part. The landscape is mainly a series of moderately narrow sharp-topped and knobby ridges separated by comparatively deep narrow valleys with rather steeply sloping sides and narrow nearly level bottoms. The more conspicuous ridges parallel the strike of the underlying bedrock strata. In places the ridges have been reduced considerably and more nearly resemble hills with moderately sloping sides and well-rounded tops. Some of the highest and most steeply sloping ridges have small or thin interbeds of sandstone exposed at or near their crests. Other similar but much less extensive areas of the knobs occur along the southeastern edge of the Ridge and Valley part of the county adjacent to the mountains and foothills. These smaller areas are occupied chiefly by Litz and Teas soils, whereas the more extensive area in the northern part of the county is occupied by associations that include the Danridge soils. (See fig. 2.) All of the soils of the upland part are shallow over bedrock and are excessively drained.

The valley land.—This land represents an area of low-lying ridges and valleys underlain chiefly by dolomitic limestone. The area averages about 5 miles in width and extends from the northeastern county boundary in a southwestern direction nearly across the central part of the county. It comprises approximately the southeastern half of the Ridge and Valley section. The relief is dominantly rolling to hilly. The major part is underlain almost wholly by comparatively chert-free and moderately cherty limestone. and it is less rugged than the other three subdivisions.

Sinkholes characterize much of the valley land underlain by limestone. They vary considerably in size and depth, but most of them range from a few square rods to a few acres in area and from about 10 to 40 feet in depth. Some are walled by rather steep slopes, but most of them have gently or moderately sloping sides. Some are deeper and steeper on one side than on the other, but most of them are roughly cone-shaped. The deepest ones usually have the smallest

diameter and the most steeply sloping sides. Some are not crossable with farm machinery, but most of them are farmed intensively, especially at or near the lower levels, because of the unusually high productivity of the soil there. Some hold water much of the time and serve advantageously as watering places for livestock. Most, however, hold water for only short periods in spring or after unusually heavy rains. Some have subterranean outlets sufficiently open to remove water as rapidly as it comes to the sinks.

The foothills.—These represent an area of steep, comparatively high hills and ridges or low mountain ridges along the edge of the Blue Ridge part of the county. They are intermediate in height and character between the hills and ridges of the Ridge and Valley section on the north and northwest and the higher mountain peaks to the south and southeast. They are underlain chiefly by slate with interbeds of quartzite and conglomerate. The latter rocks are most resistant to weathering and are exposed mainly along the crests of some of the highest hills and ridges. Upon weathering, the material derived from slate resembles that from shale, and that from the interbedded rocks is similar to that from sandstone. The slope is dominantly steep, and the relief is from 250 to 600 feet. Practically all the ridges have narrow, winding, uneven, or jagged tops and are separated by deep, steep-sided valleys with narrow, irregular bottoms. The crests of some of the higher ridges or main divides parallel the strike of the underlying rock, but most of the minor ridges radiate in all directions from the main divides. All the soils, except the Jefferson, are shallow over bedrock and are excessively drained. The Jefferson soils normally are moderately deep and well drained.

The mountains.—This subdivision of the Blue Ridge province is in the southeastern part of the county. It is the most conspicuous physiographic feature of the area. The principal feature is a main divide that extends continuously, except where cut by the Pigeon and French Broad Rivers, in a general northeast-southwest direction along the southeastern county boundary. This divide is known as the Bald Mountains, which are a part of the Great Smokies. English, Stone, Meadow Creek, Green, and Neddy Mountains are outliers that are separate from the main chain. The top of the principal divide consists chiefly of granite, gneiss, and schist, which give rise to the Ashe soils; the adjacent secondary divides are underlain coextensively by hard massive slate and conglomerate, giving rise to shaly silt loam Ramsey soils; and the great outliers consist almost wholly of quartzite and conglomerate on which sandy Ramsey soils predominate.

The relief is dominantly steep or very steep. Some areas are rough, broken, or precipitous. Some of the most prominent ridges, especially those underlain by granite, gneiss, and schist, are somewhat rounded on top and have fairly smooth or even crests; but most of them are sharp-topped, or jagged, and present an uneven skyline characterized by moderately high peaks and low gaps. Most of the intervening valleys are covelike and V-shaped with very steeply sloping sides and narrow bottoms having considerable downstream gradient. Many of the valleys high up on the mountainsides resemble small gorges. Most of the mountain areas are shown on the soil map as Rough mountainous land (Ramsey soil material). Practically all the soils on the mountains are shallow or very shallow to bedrock and are excessively drained.

RELIEF

Elevations range from a low of about 1,000 feet at the surface of Douglas Reservoir to a high of 6,636 feet on Mount Guyot. Most ridge tops in the Ridge and Valley province of the county range from 1,250 to 1,400 feet above sea level and from about 200 to 280 feet above the adjacent flood plains, whereas those in the Blue Ridge (or mountainous) section are much more variable in height. The highest peaks are on the mountain divide along the Tennessee-North Carolina State line. Most of this divide ranges from 3,000 to 6,000 feet above sea level. Secondary peaks and ridges within the Blue Ridge part of the county form foothills adjacent to the mountains proper, are considerably lower and somewhat more uniform in height than the higher ones, and range from about 2,000 to 3,000 feet above sea level and from about 600 to 1,600 feet above the adjacent bottom lands. Although lower and more uniform in height than the mountain peaks, they are higher and less uniform than the ridges in the valley land. Flood plains and low terraces along the larger streams vary in elevation from about 960 to 1,200 feet. Most high stream terraces are 80 to 200 feet above the adjacent flood plains. The approximate elevation above sea level of the highest of these is 1,200 feet. Newport on the Pigeon River and near the center of the county is 1,096 feet above sea level at the United States Weather Bureau station.

DRAINAGE

All soils of the county are at least moderately well drained except for areas in limestone sinks or the low, nearly flat parts of some of the stream terraces and first bottom lands. Here, drainage is slow or poor. A few small imperfectly drained areas are at or near the base of some slopes where seepage occurs.

All runoff water flows to the French Broad River and thence to the Tennessee River. The Pigeon and Nolichucky Rivers are the largest tributaries of the French Broad. All of the streams have relatively rapid flow, and except along the lower part of the French Broad their alluvial plains are narrow. Springs are common throughout much of the county.

The uplands dominate in both physiographic provinces. The colluvial slopes and first bottoms are about equally divided between the two provinces, whereas the terraces are largely within the Ridge and Valley area. The colluvial slopes consist of materials washed or rolled from the adjacent uplands and terraces, whereas the stream terraces and much of the bottom lands consist of alluvium. Many high terraces may or may not be related to the present drainage system, but all the low terraces apparently were formed by the present streams. Most bottoms, including those along the rivers, are comparatively narrow and irregular, ranging from only a few yards to less than one-half mile in width.

CLIMATE

According to Koppen's classification (*9*) most of Cocke County is in the Humid Mesothermal climatic zone and has no distinct dry season but has hot summers. The highest parts in the more mountainous sections are in the zone designated as having cool summers. Table 1 gives the normal monthly, seasonal, and annual temperature and precipitation at Newport.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Newport, Cocke County, Tenn.*

[Elevation 1,096 feet]

Month	Average [1] temperature	Precipitation [2]		
		Average	Total amount for the driest year	Total amount for the wettest year
	°F.	*Inches*	*Inches*	*Inches*
December	39. 1	4. 03	1. 21	4. 83
January	38. 2	3. 68	2. 08	3. 44
February	40. 0	3. 91	1. 01	5. 93
Winter	39. 1	11. 62	4. 30	14. 20
March	48. 4	4. 84	3. 73	4. 12
April	56. 9	3. 66	2. 95	2. 96
May	65. 8	4. 25	1. 93	5. 02
Spring	57. 0	12. 75	8. 61	12. 10
June	74. 1	4. 30	2. 51	4. 27
July	76. 7	4. 48	7. 55	9. 05
August	75. 6	3. 94	2. 55	7. 30
Summer	75. 5	12. 72	12. 61	20. 62
September	70. 6	2. 78	. 89	4. 28
October	58. 1	2. 47	1. 64	2. 63
November	46. 5	2. 47	2. 05	3. 55
Fall	58. 4	7. 72	4. 58	10. 46
Year	57. 5	44. 81	[3] 30. 10	[4] 57. 38

[1] Average temperature based on 61-year record, 1890 to 1950.
[2] Average precipitation based on 61-year record, 1890 to 1950.
[3] In 1941.
[4] In 1945.

The highest temperature reported at Newport since 1930 is 106° F., and the lowest, −3°. The average frost-free period is about 198 days, the last killing frost averaging April 9, and the first killing frost October 25. The frost-free period is shorter in the mountains. According to the Weather Bureau data from the Newport station, killing frosts have occurred as late as May 2 and as early as September 26. These data are representative of the Ridge and Valley part of the county. In the areas of high elevation, the temperature is cooler and the precipitation is greater. At an elevation of 2,186 feet at Elkmont in Sevier County, the average annual temperature is 55.7°; at an elevation of 6,684 feet on Mount Mitchell about 40 miles east of Cocke County the average annual temperature is 42.9°. The average annual precipitation at Elkmont is 63.45 inches, and at Mount Mitchell 69.05 inches.

Less obvious but nevertheless significant differences, especially in temperature, are noted between various parts of each physiographic province. Frost occurs more frequently in sinkholes and on lower slopes than on the adjacent higher slopes and ridge tops. Slopes facing north can be expected to have a lower average temperature and warm more slowly in spring than those facing south. For this reason they may be preferable for fruits that are subject to killing by late spring frosts. Favorable moisture conditions extend farther into the driest part of the growing season on the stronger north-facing slopes than on comparable south-facing exposures. The deep drains and coves in the mountains are recognized as favorable sites for hemlock, yellow-poplar, and other native plants that flourish under cool, humid conditions.

Winter temperatures in the Ridge and Valley part are characterized by rapid changes and short cold spells during which light freezes occur for two or three nights and are then followed by rising temperatures. Certain kinds of outdoor farm work can be done throughout the winter when moisture conditions permit. Such fall-planted grains as wheat, oats, and barley, as well as red clover, alfalfa, crimson clover, and vetch, are not commonly damaged by winterkilling. When damage occurs, it is because the crop failed to attain sufficient growth in the fall as a result of late seeding, lack of moisture, inadequate fertility, or some combination of these conditions. Hardy greens survive through the winter, and under a high level of management grazing vegetation can be maintained throughout a great part of the year. Usually, however, there is little vegetative growth from November 1 to March 1. For short periods during the winter season, wet soil or snow may make grazing impractical or impossible.

The annual precipitation is fairly well distributed throughout the year. The lightest precipitation occurs in fall and coincides well with the harvesting of corn, tobacco, and other important crops. The dry fall season, however, is disadvantageous to fall-planted crops and late-season grazing.

Snow occurs only occasionally and lightly in the lowland or valley land but is common in the higher parts of the mountains. It frequently falls in the mountains concurrently with rains at the lower elevations. Snow on the valley land usually melts within a few hours or days except in shaded areas or at or near the top of some of the highest ridges. In the mountains it may remain for several days or even weeks during the coldest winter periods.

Most rain in winter falls slowly and usually over a period of several hours; most of that in summer comes rapidly in thunderstorms, occasionally accompanied by hail. The ground seldom freezes to a depth of more than 2 inches, and soil moisture is generally abundant at the start of the growing season. Runoff during the late winter and early spring causes erosion on sloping areas not protected by vegetation.

Temperature, moisture, and sunshine provide notably favorable growing conditions during the spring and early summer, but moisture supplies are commonly below the optimum for plant growth during the late summer and fall. As a result, growth is restricted. Crop failures from lack of moisture, however, are extremely rare. Investigations and experience have shown that in many years during this

drier period, crops that are in their growing stage respond to irrigation. Stream overflow, or flooding, is greatest late in winter or early in spring, but crop losses are not great at these seasons. Occasional flash floods during the summer cause some crop losses.

Strong winds are not common except those accompanying thunderstorms. Tornadoes are very rare. The average wind velocity is low except for the highest mountainous parts; the average for the year is 8 to 10 miles an hour (*6*). The windiest season is early spring. The cloudiest period is during the winter season, and the clearest is during the late summer and fall.

WATER SUPPLY

An adequate supply of water for both household and livestock use is available throughout the year in nearly all parts of the county except on steep ridges and in some areas underlain by limestone. Drinking water is obtained from permanent springs in many places. In areas underlain chiefly by limestone—where springs are less numerous or do not maintain a permanent flow—water is obtained either from wells or cisterns. Some wells are too shallow to serve as a reliable source, but those that are of sufficient depth and are well cared for afford an adequate supply of good quality for most household and livestock needs. Water for the city of Newport is obtained from deep wells drilled into limestone bedrock.

Water for livestock is also obtained from streams and artificial lakes and ponds. Small artificial ponds for watering livestock are chiefly in areas underlain by limestone. Such ponds usually dry up during late summer, but their use for stock in the spring and early summer months generally enables the farmer to hold enough water in reserve in cisterns and wells to carry through the critical periods. Ordinarily, the use of such ponds is important in these particular localities, especially where the water supply is a major factor in determining the number of livestock that can be raised on a farm. Most major streams are spring-fed and flow continuously throughout the year. Many of the tributaries dry up during late summer and fall. Water of the French Broad and the Pigeon Rivers is polluted by waste from factories, chiefly paper mills, upstream from Cocke County.

VEGETATION

According to the classification of natural vegetation by Shanz and Zon (*8*), Cocke County is in the chestnut-chestnut oak-yellow poplar and the birch-beech-maple-hemlock subdivisions of the oak (Southern hardwoods) forest belt of the eastern forest region. A very small part is in the spruce-fir (Northern coniferous) forest belt. The forest species, their distribution by soil associations, and suggestions for improved management will be found in the section on Forests.

ORGANIZATION AND POPULATION

The first settlement within the present boundaries of Cocke County was along Nolichucky River in 1783 (*5*), and the county was formed from a part of Jefferson County in 1797 (*7*). Newport was organized and made the county seat in 1884. The first railroad was completed from Morristown to Newport in 1867, and several years later it was completed to Asheville, N. C. A branch railroad was built along the

Pigeon River to Waterville, N. C., but after removal of the greater part of the virgin forest it was abandoned.

According to the U. S. Census, the population was 22,991 in 1950. Of this, 3,892 was urban, and 19,099 was rural.

INDUSTRIES

Most of the people are engaged in farming and other closely related activities involved in the processing and marketing of farm produce and supplying goods required by the farm population. Many families operate small acreages in addition to working part time in industry, and some work almost wholly in industry. The principal industries within the county include feed and flour mills, two small knitting mills, a cannery, a leather tannery, and numerous small lumber and woodworking plants. Retail stores, principally at Newport and Parrottsville, cater chiefly to farm trade.

TRANSPORTATION AND MARKETS

Transportation and market facilities for farm produce are adequate for most needs and are keeping abreast with the demand in most places. Newport, the main shipping point, is on a division of the Southern Railway system that connects with its two main lines, one at Morristown, Tenn., and the other at Spartanburg, S. C. Federal and State highways afford good outlets to Knoxville, Morristown, and Greeneville, Tenn., and Asheville, N. C. Rural roads are maintained throughout the valley part of the county, but they are fewer and less adequate in the mountain part. According to the 1950 census, 879 of the farms were within 0.2 mile of an all-weather road. The Great Smoky Mountains National Park and Douglas Reservoir are important natural recreation centers partly within the county.

FARM AND HOME IMPROVEMENTS AND SOCIAL FACILITIES

School and church facilities are located throughout the county except in the most rugged mountainous parts. Telephone service in the county is not complete. In 1950, only 135 farms reported telephones. Electric distribution lines reach much of the county and are being extended further. In 1950, 1,446 farms had electric service, of which 1,431 received it from a power line. There were 1,084 automobiles, 511 motortrucks, and 302 tractors on farms in 1950.

AGRICULTURE

Cocke County is predominantly agricultural. General farming, chiefly livestock (beef cattle and dairy products), supplemented with a cash crop and poultry, prevails. Of the total 277,760 acres of land in Cocke County in 1950, 177,886 acres was in farms. Of this, 42,557 acres was cropland harvested (1949) and 63,440 acres was woodland. Most of the rest was used as pasture.

CROPS

Corn is the chief crop from the standpoint of acreage. It is grown mainly for grain and forage, although a small part is ground to meal for table use. It is grown on most farms and on a wide variety of soils. Yields vary greatly according to the soil and management.

Tobacco is the chief cash crop, and 1,905 farms reported acreage in 1950. All small grains are fall-planted. Wheat is used for flour and feed; the other grains, chiefly for grain feed and hay. All are used to some extent for winter and early spring grazing.

Clover and timothy, alone or mixed, account for less than a fifth of the hay produced. The acreage of lespedeza is greater, but the average yield is less because this crop is grown on a wider variety of soils and frequently under a lower level of management. Alfalfa acreage is increasing, and fairly good yields are obtained. It is more exacting in its fertility and other soil requirements, and farmers consistently strive to meet the requirements more nearly for alfalfa than they do for lespedeza.

Good quality fruits and berries can be produced on many soils, but they are not an important source of income. Many of the fruit trees reported by the census are grown under a low level of management and give low yields of only fair quality.

The acreage of the principal crops and number of fruit trees and grapevines in stated years are given in table 2.

TABLE 2.—*Acreage of the principal crops and number of fruit trees and grapevines of bearing age in Cocke County, Tenn., in stated years*

Crop	1919	1929	1939	1949
	Acres	*Acres*	*Acres*	*Acres*
Corn for grain	31, 206	24, 590	24, 737	15, 675
Oats threshed	1, 958	447	503	1, 430
Wheat threshed	13, 668	5, 870	6, 819	2, 968
Rye threshed	713	423	630	65
Barley threshed	9	160	901	310
Hay, total	9, 790	12, 309	15, 090	17, 759
Alfalfa	68	179	409	1, 836
Clover and timothy, alone or mixed	6, 501	8, 548	5, 561	3, 235
Other tame hay	1, 963	1, 976	1, 091	2, 715
Wild hay	219	89	260	(1)
Small grains cut for hay	397	121	319	941
Lespedeza	(1)	(1)	6, 887	8, 693
Annual legumes	642	1, 396	563	339
Silage and forage	6, 474	1, 001	465	422
Sorghum for sirup	367	54	75	2
Irish potatoes	345	472	382	116
Sweetpotatoes	193	166	114	31
Other vegetables harvested for sale	603	1, 930	1, 595	999
Lespedeza seed	(1)	(1)	248	149
Red clover seed	(1)	(1)	362	67
Tobacco	665	1, 845	2, 159	2, 256
Small fruits	20	22	4	3
	Number	*Number*	*Number*	*Number*
Apple trees	51, 401	42, 365	36, 190	30, 640
Peach do	29, 077	27, 254	21, 521	5, 163
Pear do	1, 888	1, 720	1, 773	1, 135
Cherry do	2, 701	3, 009	4, 888	2, 521
Plum and prune do	5, 071	4, 154	2, 831	1, 207
Grapevines	4, 429	3, 212	4, 238	3, 152

[1] Not reported.

PERMANENT PASTURE

Permanent pasture varies greatly in its quality and carrying capacity. Much of it is on the less productive soils, and it is not adequately fertilized or otherwise properly cared for. Where fertility is at a low level, broomsedge, lespedeza, and crabgrass are common. Where the fertility is at a high level, the lime requirement is met, proper seeding is carried out, and moisture relations are favorable, the more desirable legumes and grasses such as white clover, orchard grass, bluegrass, Bermuda grass, and lespedeza afford good quality grazing of fair to high carrying capacity.

LIVESTOCK

Chickens and eggs are produced for sale on most farms, but few have other poultry. A few hogs are raised chiefly for home consumption; a few are marketed. The few sheep are raised on a small number of farms. According to the U. S. Census, only 21 farms reported sheep in 1950. They are raised for both wool and mutton. Table 3 shows the number of domestic animals on farms in Cocke County, Tenn., in stated years. Although livestock enterprises are among the main sources of income, they are not carried on intensively. As classified by type of farm, there were 197 dairy, 106 livestock, and 5 poultry farms in 1950. Dairying appears to be increasing. There is a market for whole milk at Newport and a processing plant at Greeneville, Tenn. Beef cattle, chiefly Hereford and Aberdeen Angus, are marketed locally or at Knoxville.

TABLE 3.—*Number of livestock and beehives on farms in Cocke County, Tenn., in stated years*

Livestock	1930	1940	1950
	Number	*Number*	*Number*
Horses and colts	1, 820	[1] 2, 180	1, 890
Mules and mule colts	2, 922	[1] 1, 790	1, 687
Cattle and calves	12, 384	[1] 11, 390	15, 640
Hogs and pigs	9, 216	[2] 6, 806	[2] 4, 582
Sheep and lambs	4, 588	[3] 1, 301	682
Goats and kids	243	[2] 153	[4]
Chickens	[1] 114, 166	[2] 117, 122	[2] 97, 919
Other poultry	[4]	[2] 2, 029	[2] 152
Beehives	2, 834	2, 096	2, 541

[1] Over 3 months old.
[2] Over 4 months old.
[3] Over 6 months old.
[4] Not reported.

SIZE AND TYPES OF FARMS

Farms generally are small; 81 percent of them have less than 100 acres, and 43 percent of all land in farms is on farms of less than 100 acres.

The farms of Cocke County, classified according to size in 1950, are as follows:

Acres:	*Number of farms*
Under 10	298
10 to 29	662
30 to 49	466
50 to 69	360
70 to 99	291
100 to 139	215
140 to 179	113
180 to 219	49
220 to 259	32
260 to 499	69
500 to 999	16
1,000 and over	4

The farms of Cocke County, classified by type of farm in 1950, are as follows:

Type of farm:	*Number*
Field crops	964
General	274
Dairy	197
Livestock	106
Vegetable	21
Fruit and nut	5
Poultry	5
Miscellaneous and unclassified	1,003

FARM TENURE

The U. S. Census for 1950 states that tenants operate 23.3 percent of the farms. Of these, 345 are croppers (share tenants to whom their landlords furnish all the work animals or tractor power in lieu of work animals), 171 are share tenants who provide their own work animals or tractors, 17 are cash tenants, 3 are share-cash tenants, and 65 are unspecified tenants. Managers operate 3 farms, and owners or part owners operate 1,971 farms.

THE SOILS OF COCKE COUNTY, THEIR USE AND MANAGEMENT

The soils of Cocke County differ greatly in color, texture, consistence, reaction, fertility, relief, stoniness, depth to underlying material, permeability, and drainage. All these characteristics affect the productivity, workability, and conservability of the soils and determine their agricultural uses and management requirements.

The soils range in color from nearly white through gray, yellow, and brown to red. Colors intermediate between brown and gray predominate in the surface soils, whereas the subsoil colors cover the range of yellow, red, brown, and gray. Texture and consistence vary from loose incoherent sand to plastic clay. Most of the surface soils range from clay loam to fine sandy loam and are usually mellow and friable. The subsoils are mainly silty clay loam, clay loam, or silty clay, varying from friable to plastic.

The soils are prevailing rolling to steep in the Ridge and Valley province (valleys) and steep to very steep in the Blue Ridge province. The degree of erosion varies greatly. To a large extent the soils in the mountain part are uneroded or only slightly eroded; but many in the valleys are eroded to severely eroded. Thickness over bedrock

ranges from a few inches to more than 20 feet. Loose fragments of chert, cobbles, gravel, or stones that interfere materially with cultivation are common in a few soils.

The soils of the uplands and high terraces were severely leached during development, leaving them acid and relatively low in fertility and organic matter. They differ in fertility and organic-matter content even in the virgin state, and such differences have been widened by cropping, erosion, and other artifically stimulated processes of impoverishment. In contrast to the soils of the uplands and high terraces (high benches), many soils of the bottoms and low terraces (second bottoms) are permeable, high in natural fertility, moderately well supplied with bases, especially lime, and fairly well supplied with organic matter.

These differences in characteristics cause the soils to differ in their relative use suitability in the present agriculture. Some are highly productive, easy to work, and easy to conserve and are therefore physically well suited to agricultural uses. Others are low in productivity, difficult to work, and difficult to conserve and are unsuited or very poorly suited to agriculture. Most of the soils, however, are between these two extremes. About 30 percent of the county is thought suitable for crops as well as for pasture and forest, 32 percent for permanent pasture or forest, and 38 percent only for forest.

SOIL SERIES AND THEIR RELATIONS

On the basis of differences in their characteristics, the soils have been classified into 38 series and 9 miscellaneous land types. In order to make full use of the soil survey, it is necessary to know the soils and to understand their relationships to each other. These relationships are more easily seen if the soils are placed in groups based on their position in the landscape. The soils of Cocke County are placed in four groups: (1) Soils of uplands, (2) soils of terrace lands, (3) soils of colluvial lands, and (4) soils of bottom lands.

The grouping of the soil series in table 4 shows their topographic position, parent material, and drainage.

SOILS OF UPLANDS

Soils of the uplands are in the higher lands above the valley floors. They are closely related to their parent rock, and generally the underlying rock is similar to their parent material. The four classes of rocks from which soils have been derived in Cocke County are: (1) limestone, (2) shale and slate, (3) quartzite, conglomerate, and sandstone, and (4) micaceous rocks.

The Dewey, Dunmore, and Groseclose soils developed from limestone. The Dewey soils are distinguished by the brown surface soil and firm but friable red subsoil. The Dunmore soils have a yellowish-brown surface soil and a more compact subsoil than the Dewey soils. The Groseclose soils have a pale-brown, light-gray, or grayish-yellow surface soil and a yellow subsoil, and in most places the subsoil is very firm and plastic. Shaly bedrock material or limestone is at a shallower depth than is common for the Dewey and Dunmore soils. Much of the acreage of these three series is useful for agriculture.

The Dandridge, Litz, Teas, and Ramsey soils are all shallow to shaly or sandy bedrock, and their surfaces are predominantly hilly to

TABLE 4.—*Soil series of Cocke County, Tenn., grouped according to topographic posi*

Parent material	Excessively drained [1] (rolling to very steep)	Well drained [2] (undulating to steep)	
SOILS OF UPLANDS			
Sedimentary rocks:			
High grade limestone	----------	Dewey	
Slightly clayey limestone	----------	Dunmore	
Shaly limestone or limestone with shale interbeds.	----------	Groseclose [5]	
Calcareous shale	Dandridge [6]		
Leached calcareous and acid shale with a few limestone lenses.	Litz [6]		
Purplish shale, parts calcareous	Teas [6]		
Igneous and metamorphic rocks:			
Quartzite, conglomerate, and slate	Ramsey		
Light-colored gneiss and granite	Ashe		
SOILS OF TERRACE LANDS			
Old alluvium:			
Chiefly gneiss and granite	----------	Altavista [5]	
Limestone, some sandstone, quartzite, and shale.	----------	Cumberland	
Sandstone, quartzite, limestone, and shale	----------	Waynesboro	
Do	----------	Nolichucky	
Do	----------	Holston [5]	
Sandstone, quartzite, limestone, and shale (low terrace).	----------	Sequatchie [6]	
Gneiss and granite (low terrace)	----------	State	

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Soils of Colluvial Lands		
High grade limestone		Emory [8]
Cherty limestone		Greendale [5 8]
Limestone		
Purplish shale, parts calcareous		Camp [5]
Calcareous shale		Whitesburg [5 8]
Shale		Leadvale [5]
Sandstone and quartzite with some limestone or calcareous shale.		Hayter
Sandstone, quartzite, shale, and some limestone.		Allen
Sandstone, quartzite, and shale		Jefferson [6]
Do		Barbourville [5 8]
Gneiss and granite		Tusquitee [5]
Soils of Bottom Lands		
Cherty limestone		
Chiefly calcareous shale and slate, some sandstone and quartzite.		Staser [5 8]
Gneiss and granite		Congaree [5 8]
Gneiss and granite (sandy component)	Buncombe [6 8]	

[1] Indistinct profile due to rapid geologic erosion; surface runoff rapid to very rapid; internal drainage low to very low; color varies with parent material.

[2] Brown or reddish-brown to yellowish-brown soils, free of mottlings to a depth of about 30 inches.

[3] Pale-yellow soils—grayish-brown or yellowish-gray mottled below about 12 inches.

[4] Light brownish-gray t inches.

[5] Ranges from well drai

[6] Ranges from excessivel

[7] Ranges from imperfect

[8] These soils do not h because of the short time t

very steep. The Dandridge soils are yellowish gray or grayish brown and shaly and developed over calcareous shale. Though not well suited to crops, much of their acreage is capable of producing good pasture.

The Litz soils are yellowish gray to light yellowish brown and shaly, but the underlying rock consists of either leached or acid shale with a small quantity of interbedded limestone. The better phases of the Litz soils are suited to pasture.

The Teas soils are dusky red or purplish and are underlain at a shallow depth by dusky-red or purplish shale, parts of which are calcareous. Part of the small aggregate acreage is suited to pasture, but much of it is still under native forest.

The Ramsey soils are the most variable of this group. Some have a sandy grayish surface soil and a thin yellowish subsoil over such sandy rock as quartzite or conglomerate; others have a brown surface soil shallow to slaty material. The parent rock of all of them was moderately to strongly metamorphosed. The sandier Ramsey soils are low in fertility and of little value other than for forest, but the less steep areas of the more silty soils are capable of producing pasture.

Soils of the Ashe series are of small extent and have brown to grayish-yellow loam surface soils and yellowish friable clay loam subsoils with light-colored gneiss or granite bedrock at depths of 1 to 3 feet or more. These soils are very permeable, but they are strongly acid and low in fertility. The less steep parts are suited to crops and pasture under proper management.

SOILS OF TERRACE LANDS

Soils of the terrace lands consist of old alluvium—material deposited by streams but now lying well above floodwaters. Most areas occur as benches adjacent to the present flood plains of the larger streams, although some occupy positions well removed from the present stream courses. These old alluvial deposits range in thickness from less than 2 to about 25 feet.

The Cumberland, Waynesboro, and Nolichucky soils have reddish subsoils, are well drained, and are on high stream terraces. Their elevations vary from 60 to 180 feet above the first bottom lands of the adjacent larger streams. The surface layer of Cumberland soil is dark brown, and the subsoil is red to brownish red or yellowish red. The Waynesboro surface layer is lighter brown, and the subsoil is lighter red. The Nolichucky soils have grayish shades of brown and yellow, and the subsoils are strong brown or reddish yellow. In general, both the Waynesboro and Nolichucky soils contain a notable quantity of sand in the surface and subsurface layers, whereas the Cumberland soil has very little sandy material in it. A great part of these terrace soils is suited to crops; the Cumberland is the most productive.

The Holston, Monongahela, and Tyler soils, like the Cumberland, Waynesboro, and Nolichucky, consist of old alluvium. The Holston has a yellow subsoil and is moderately well drained; the Monongahela has a mottled yellow and gray subsoil and slow internal drainage; and the Tyler soil is predominantly gray throughout much of its depth and has poor or very slow drainage. Soils of these series are on lower stream terraces than the Cumberland, Waynesboro, and Nolichucky,

and their natural fertility is lower. Their suitability for use is more limited; much of the Tyler soil is not suited to crops.

The Sequatchie and State soils are brown well-drained permeable soils on low stream terraces. The State soil is distinguished by its higher content of mica, as its parent material was derived chiefly from micaceous rocks.

The Altavista soil ranges from well drained to imperfectly drained; it is a yellowish-brown soil on low stream terraces. The Augusta soil, in depressions on the low stream terraces, is a yellowish-brown soil with imperfect to poor drainage.

SOILS OF COLLUVIAL LANDS

Soils of the colluvial lands consist of local alluvium and creep from the adjacent uplands, or in other words, colluvium.[8] They lie on gentle foot slopes or along drainageways at the base of the upland slopes from which their parent material has been removed. Some of these soils are young, the material having been deposited in relatively recent times. Others are older and have well-defined surface and subsurface layers.

The Emory, Greendale, and Ooltewah soils are young and consist of material predominantly from limestone. They are productive and desirable for cultivation. The well-drained Emory soil has a brown surface layer and a reddish to brownish subsoil. The Greendale soil has a lighter colored surface soil, yellow subsoil, a moderate content of chert, and imperfect internal drainage in some areas. The Ooltewah soil occupies sinkholes and has slow internal drainage and a mottled subsoil.

The Camp, Whitesburg, and Leadvale soils consist of alluvium and creep originating from shaly rocks. The Camp is of very limited extent and occupies drainways in areas of Teas soils. It is pinkish, purplish, or reddish brown, and most parts are well drained. The Whitesburg soil consists of recent alluvium along drainways in areas of Dandridge soils, and much of the parent material originated from calcareous shale. The Leadvale soils occupy foot slopes and generally consist of the same kind of material as the Whitesburg. Leadvale soils are older and have a pale-yellow surface soil and a firm yellow subsoil. They are moderately well drained and commonly mottled below 24 inches. All of the Camp, Whitesburg, and Leadvale soils are suited to crops.

The Hayter soil occurs on gentle foot slopes in association with the shaly silt loam Ramsey soils. It is yellowish brown, well drained, and productive. The Allen and Jefferson soils are old and occupy slopes in association with the more sandy Ramsey soils. The Allen soils have a yellowish-brown to reddish-yellow surface soil and a yellowish-red subsoil, whereas the Jefferson soils have a yellowish or grayish surface soil and subsoil. The soils of both the Allen and Jefferson series are well drained, and their suitability for agriculture depends on the slope and degree of stoniness.

The Barbourville and Cotaco soils are on recent alluvium along the drainways associated with Allen, Jefferson, and Ramsey soils. They are younger than the Allen and Jefferson soils and occupy lower

[8] Colluvium consists of poorly assorted material that has been moved to the foot of slopes by gravity, frost action, soil creep, and local wash.

positions. The Barbourville soils are better drained than the Cotaco and free of mottlings to a depth of about 26 inches. Both are suited to crops or pasture.

The Tusquitee are brown friable well-drained soils on foot slopes of young alluvium and creep carried from the Ashe soils of the adjacent higher slopes. These are productive soils, but their aggregate area is small.

SOILS OF BOTTOM LANDS

Soils of the bottom lands consist of recent general alluvium that is subject to flooding or inundation. They have nearly level surfaces and are confined to strips or belts along the creeks and rivers. The Lindside soil consists chiefly of material washed from soils developed from limestone, and all of it is along creeks in limestone areas. Although imperfectly drained, it is fertile and productive of certain crops and pasture. The Staser, Hamblen, and Prader soils consist of mixed alluvium from shale, slate, quartzite, sandstone, and limestone. The Staser soils are well drained, the Hamblen imperfectly drained, and the Prader poorly drained. All have a variable content of cobbles where their material originated in part from quartzite. The Staser and Hamblen soils are suited to intensive use for crops, but the poor drainage of the Prader greatly limits its suitability.

The Congaree, Chewacla, Wehadkee, and Buncombe soils consist of young alluvium originating chiefly from such micaceous rocks as gneiss and granite, and they are recognized by their large quantity of mica flakes. The well-drained Congaree has a brownish color to a depth of 30 inches; the imperfectly drained Chewacla is mottled in its 18- to 36-inch layer; and the poorly drained Wehadkee is gray or mottled throughout its entire depth. The excessively drained Buncombe soil is very sandy and is low in plant nutrients. The Congaree soils are the most productive and have the widest suitability for agriculture. The Chewacla compares well in use suitability with the Hamblen and Lindside soils, and the Wehadkee with the Prader.

SOIL TYPES AND PHASES

In the following pages, the soils of Cocke County are described in detail and their relation to agriculture is discussed. Their acreage and proportionate extent are listed in table 5, their management requirements are given in the section on Use and Management of Soils, and their location and distribution are shown on the accompanying soil map.

Allen fine sandy loam, rolling phase (5–12% slopes) (Ad).—This soil, like others of its series, has a reddish friable subsoil and has developed from old local alluvium that washed chiefly from the more sandy Ramsey soils. It is well drained and occupies foot slopes below mountain areas underlain by quartzite or sandstone—positions similar to those of the Jefferson soils. The soil differs from the Jefferson soils in having a reddish rather than yellowish subsoil, and most areas are over limestone rather than shale, slate, or quartzite. This soil and other Allen soils occur along the outer, or lower, edge of the Jefferson-Allen-Barbourville soil association, chiefly at the foot of English, Stone, and Meadow Creek Mountains.

TABLE 5.—*Approximate acreage and proportionate extent of the soils of Cocke County, Tenn.*

Soil	Acres	Percent
Allen fine sandy loam:		
Eroded hilly phase	132	0.1
Eroded rolling phase	273	.1
Hilly phase	169	.1
Rolling phase	105	(1)
Allen stony fine sandy loam, eroded hilly phase	99	(1)
Altavista loam	229	.1
Ashe loam:		
Hilly dark-colored phase	366	.1
Hilly phase	225	.1
Steep phase	1,059	.4
Augusta silt loam	464	.2
Barbourville fine sandy loam	2,174	.8
Barbourville silt loam	3,159	1.1
Barbourville stony fine sandy loam	3,180	1.1
Buncombe loamy fine sand	1,515	.5
Camp silt loam	111	(1)
Chewacla fine sandy loam	933	.3
Congaree fine sandy loam	1,272	.5
Congaree loam	833	.3
Cotaco fine sandy loam	1,996	.7
Cumberland silty clay loam, eroded undulating phase	266	.1
Dandridge and Litz shaly silt loams:		
Eroded hilly phases	2,588	.9
Eroded rolling phases	4,142	1.5
Eroded steep phases	8,112	2.9
Dandridge and Litz silt loams:		
Hilly phases	553	.2
Rolling phases	225	.1
Steep phases	1,673	.6
Very steep phases	9,057	3.3
Dandridge shaly silt loam:		
Eroded hilly phase	2,058	.7
Eroded rolling phase	2,733	1.0
Eroded steep phase	6,500	2.3
Dandridge silt loam:		
Hilly phase	442	.2
Rolling phase	143	.1
Steep phase	2,331	.8
Very steep phase	1,353	.5
Dewey silt loam, hilly phase	132	.1
Dewey silty clay loam:		
Eroded hilly phase	618	.2
Eroded rolling phase	1,373	.5
Eroded steep phase	270	.1
Dunmore silt loam:		
Hilly phase	2,221	0.8
Rolling phase	1,834	.7
Steep phase	400	.1
Dunmore silty clay:		
Severely eroded hilly phase	3,892	1.4
Severely eroded rolling phase	2,204	.8
Severely eroded steep phase	283	.1
Dunmore silty clay loam:		
Eroded hilly phase	4,093	1.5
Eroded rolling phase	5,129	1.9
Eroded steep phase	261	.1
Emory silt loam	1,257	.5
Greendale silt loam	3,912	1.5
Groseclose silt loam:		
Hilly phase	253	.1
Rolling phase	132	.1
Groseclose silty clay loam:		
Eroded hilly phase	892	.3
Eroded rolling phase	645	.2
Gullied land:		
Dandridge soil material	2,292	.8
Dunmore soil material	1,974	.7
Hamblen fine sandy loam	1,121	.4
Hamblen silt loam	2,049	.7
Hayter silt loam, eroded rolling phase	194	.1
Holston clay loam:		
Severely eroded hilly phase	183	.1
Severely eroded rolling phase	91	(1)
Holston cobbly loam:		
Eroded hilly phase	253	.1
Eroded rolling phase	382	.1
Hilly phase	144	.1
Rolling phase	194	.1
Undulating phase	319	.1
Holston loam:		
Eroded hilly phase	1,726	.6
Eroded rolling phase	712	.3
Undulating phase	1,128	.4
Jefferson-Dunmore complex:		
Eroded hilly phases	366	.1
Hilly phases	178	.1
Severely eroded hilly phases	333	.1
Jefferson loam, eroded rolling phase	672	.2

See footnotes on p. 22.

Soil	Acres	Percent
Jefferson stony sandy clay loam:		
Severely eroded hilly phase	1,084	0.4
Severely eroded rolling phase	445	.2
Jefferson stony sandy loam:		
Eroded hilly phase	1,861	.7
Eroded rolling phase	2,368	.8
Eroded steep phase	485	.2
Hilly phase	1,190	.4
Rolling phase	641	.2
Jefferson very stony sandy loam:		
Eroded hilly phase	2,068	.7
Eroded rolling phase	2,061	.7
Eroded steep phase	394	.1
Hilly phase	3,239	1.2
Rolling phase	1,391	.5
Steep phase	4,122	1.5
Leadvale silt loam:		
Rolling phase	1,457	.5
Undulating phase	478	.2
Lindside silt loam	952	.3
Litz shaly silt loam:		
Eroded hilly phase	151	[1]
Eroded rolling phase	124	[1]
Steep phase	216	.1
Monongahela silt loam	1,312	.5
Eroded phase	387	.1
Nolichucky clay loam:		
Severely eroded hilly phase	451	.2
Severely eroded rolling phase	107	[1]
Nolichucky cobbly loam:		
Eroded hilly phase	392	.1
Eroded rolling phase	370	.1
Hilly phase	170	.1
Rolling phase	128	.1
Nolichucky loam:		
Eroded hilly phase	714	.3
Eroded rolling phase	1,287	.5
Hilly phase	119	[1]
Undulating phase	275	.1
Ooltewah silt loam	396	.1
Prader silt loam	272	.1
Ramsey shaly silt loam:		
Eroded hilly phase	2,733	1.0
Eroded steep phase	11,609	4.2
Ramsey shaly silt loam—Con.		
Hilly phase	5,212	1.9
Steep phase	10,987	4.0
Very steep phase	12,482	4.5
Ramsey stony fine sandy loam:		
Eroded steep phase	827	.3
Hilly phase	1,430	.5
Steep phase	8,822	3.2
Riverwash	677	.2
Rock land (limestone)	2,368	.8
Rough mountainous land (Ramsey soil material)	51,213	18.4
Sequatchie cobbly fine sandy loam	551	.2
Sequatchie fine sandy loam	503	.2
Staser cobbly fine sandy loam	514	.2
Staser fine sandy loam	939	.3
Staser silt loam	395	.1
State loam	2,199	.8
Stony colluvium (Jefferson soil material)	2,585	.9
Stony hilly land (Dunmore soil material)	2,368	.8
Stony rough land (Ashe soil material)	11,474	4.1
Stony steep land (Dunmore soil material)	739	.3
Teas shaly silty clay loam, eroded steep phase	265	.1
Teas silt loam:		
Hilly phase	214	.1
Steep phase	1,059	.4
Tusquitee silt loam:		
Hilly phase	244	.1
Rolling phase	216	.1
Tyler silt loam	1,532	.6
Waynesboro clay loam:		
Severely eroded hilly phase	270	.1
Severely eroded rolling phase	88	[1]
Waynesboro cobbly loam, eroded hilly phase	109	[1]
Waynesboro loam:		
Eroded hilly phase	521	.2
Eroded rolling phase	1,466	.5
Undulating phase	187	.1
Wehadkee silt loam	366	.1
Whitesburg silt loam	4,907	1.8
Total	[2] 277,760	100.0

[1] Less than 0.1 percent.

[2] Includes about 3,871 acres occupied by Douglas Reservoir.

Profile description:

0 to 14 inches, light-brown or yellowish-brown fine sandy loam, notably darker in the surface 2 or 3 inches.
14 to 36 inches, yellowish-red moderately firm but friable sandy clay loam.
36 to 60 inches, red sandy clay loam streaked or splotched with brownish yellow and gray; friable with some firmness and brittleness; bedrock, generally limestone, at 3 to 10 feet.

The content of partly disintegrated quartzite or sandstone fragments is variable in most of the deep subsoil, and in some areas cobblestones and rock fragments are sufficiently abundant on the surface and in the upper subsoil to interfere with cultivation. The areas more shallow to bedrock have a redder subsoil.

This moderately fertile soil has a little higher content of organic matter than the Jefferson soil of similar slope and thickness. It is medium to strongly acid, permeable, and moderate in water-holding capacity. Tilth is good, and cultivation can be carried on under a moderately wide range of moisture conditions.

Use suitability and management.—All of this soil is under cut-over deciduous forest. It is well drained, and its good tilth and moderate moisture-holding capacity make it suitable for practically all crops commonly grown, including alfalfa and tobacco. With proper management it can be maintained at a high level of productivity in a 3- to 5-year rotation. It is capable of supporting good pasture. This soil is discussed in group 6 in the section on Use and Management of Soils.

Allen fine sandy loam, eroded rolling phase (5–12% slopes) (AB).—This soil represents areas of rolling Allen fine sandy loam that have been eroded so much that the plow layer in most places now consists of a mixture of original surface soil and subsoil material. The surface 6 inches, a reddish-yellow fine sandy loam, is underlain by a yellowish-red firm but friable sandy clay loam subsoil. Bedrock, generally limestone, lies at 2½ to 10 feet.

Where the subsoil is exposed, the plow layer is yellowish-red sandy clay loam. Much of the acreage has sufficient sandstone fragments or quartzite cobblestones on the surface and through the soil to interfere materially with cultivation. Most of these more stony areas are represented on the map by appropriate symbol.

A few areas have slopes less than 5 percent, but the normal range is from 5 to 12 percent. Fertility is moderate, and internal drainage is medium.[4] The soil is permeable, and tilth is good unless the plow layer consists largely of subsoil material. Those areas having the plow layer made up mostly of subsoil are cloddy and have less favorable moisture conditions.

Much of the acreage is in the Jefferson-Allen-Barbourville soil association on the valley slope east of English Mountain and in Houston Valley. It is in landscapes consisting predominantly of soil suited to crops or pasture, though rough mountain areas are usually nearby.

Use suitability and management.—All of this phase has been cleared and cultivated. Most areas are used for crops or pasture, but small acreages may be idle for 2 or 3 years. Corn, small grains, tobacco, and lespedeza hay are the chief crops. This soil is desirable for most

[4] Medium internal drainage is the approximate optimum drainage for crops common to the agriculture of the county.

crops commonly grown and is productive under proper management. The moderately strong slope and shallow depth to the firmer subsoil require that care be practiced to restrain runoff water. This phase is discussed in group 6 in the section on Use and Management of Soils.

Allen fine sandy loam, hilly phase (12–25% slopes) (Ac).—This hilly phase consists of old alluvium derived chiefly from areas of Ramsey soils. It lies mostly on strong slopes below and adjacent to smoother Allen soils in the Jefferson-Allen-Barbourville soil association. Surface runoff is rapid, but internal drainage is medium. The surface layer is light-brown or yellowish-brown fine sandy loam. The subsoil is yellowish-red firm but friable sandy clay loam, streaked or splotched with brownish yellow and gray below a depth of about 28 inches. The thickness of the alluvium varies from 2 to 8 feet, and it is underlain either by limestone or residuum from limestone.

This is a moderately fertile soil with a fair content of organic matter. It is medium to strongly acid, permeable, and moderate in moisture-holding capacity. Tilth is good. Some areas have stones or cobbles in numbers that interfere materially with cultivation.

Use suitability and management.—Practically all of the hilly Allen fine sandy loam is under cut-over deciduous forest with some intermixed pine. It is suitable for crops, but its strong slope requires long rotations and other practices to restrain runoff. It will support good pasture when properly fertilized and seeded. See group 10 in the section on Use and Management of Soils for management of this phase.

Allen fine sandy loam, eroded hilly phase (12–25% slopes) (Aa).—Areas of hilly Allen fine sandy loam that have lost a considerable part of the original surface soil through erosion make up this eroded hilly phase. The 5- or 6-inch surface layer, a reddish-yellow fine sandy loam, grades to yellowish-red firm but friable sandy clay loam. Below a depth of 30 inches is red sandy clay loam, splotched with brownish yellow and gray and of firm and brittle consistence. Bedrock, usually limestone, is at 2 to 8 feet. This phase occupies some of the stronger slopes in association with the smoother Allen soils in the Jefferson-Allen-Barbourville soil association.

The small quantity of stone and cobbles is not sufficient to interfere materially with cultivation. Small areas on the more exposed slopes have lost all of the original surface soil and, in places, part of the subsoil. In these areas the plow layer consists of yellowish-red moderately firm sandy clay loam. A few shallow gullies occur in places.

This moderately fertile soil does not have a high organic-matter content. It is permeable, moderate in moisture-holding capacity, and medium to strongly acid. Tilth is good except in the more eroded areas.

Use suitability and management.—All of the eroded hilly phase has been cleared at some time, and most of it is now used for corn, tobacco, small grains, hay, and pasture. Lespedeza and grasses are the chief hay and pasture plants. It is common practice to crop this soil for a few years and then allow it to lie idle for a time before cropping is resumed. Permeability, good tilth, and response to fertilization favor cultivation, but the strong slope makes field operations and runoff control difficult. If properly fertilized, the soil is suited to the more desirable legumes and grasses for hay and pasture. This soil is discussed under group 10 in the section on Use and Management of Soils.

Allen stony fine sandy loam, eroded hilly phase (12–25% slopes) (AE).—Like other Allen soils, this one consists of old alluvium derived chiefly from the sandy Ramsey soils. It differs from Allen fine sandy loam, eroded hilly phase, mainly in having cobbles and sandstone fragments in it and on the surface in numbers that interfere with cultivation. There may be small areas where the stones are so abundant as to make field operations very difficult. The plow layer is reddish-yellow stony fine sandy loam. Below this is friable somewhat firm yellowish-red sandy clay loam that grades at about 30 inches to red friable sandy clay loam splotched with yellow and gray. Limestone bedrock is at 2 to 8 feet.

Drainage is somewhat excessive. The soil is permeable and has a moderate moisture-holding capacity. It is moderately fertile and medium to strongly acid. Tilth is good but stones interfere with cultivation. This soil is on the stronger slopes in association with smoother Allen soils in the Jefferson-Allen-Barbourville soil association.

A small acreage has slopes ranging from 25 to 40 percent. Areas on the more exposed parts have lost all of the surface soil and in places part of the subsoil. In these eroded areas the plow layer is yellowish-red friable but firm sandy clay loam. A few gullies occur in the more eroded areas.

Use suitability and management.—At some time all of this soil has been cleared and cropped, but only part of it is now used for crops, and much of it is either in pasture or idle. The soil is poorly suited to crops because of its strong slope and stoniness, but it responds well to fertilization and will support good pasture of fairly high carrying capacity. Cultivated areas require careful management to control runoff. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Altavista loam (2–10% slopes) (AF).—This yellowish-brown moderately well drained soil on low stream terraces consists of alluvium that came chiefly from micaceous rocks—gneiss and granite. All areas are above the average flood level, but some areas may be inundated by the exceptionally high overflows. The surface is predominantly undulating, but parts, especially those bordering the associated soils of the first bottoms, have a slope ranging up to about 10 percent. Most tracts are small and occur on the alluvial benches along the Pigeon, French Broad, and Nolichucky Rivers in the Congaree-State and Staser-Sequatchie soil association. Those along the French Broad and Nolichucky Rivers are associated with moderate-sized areas of soils suited to intensive use. In contrast, those along the Pigeon River are associated with extensive hilly and steep soils extremely limited in their range of suitability.

Profile description:

0 to 10 inches, pale-yellow loam.
10 to 24 inches, yellow moderately firm but friable sandy clay loam.
24 inches +, mottled yellow and gray compact brittle sandy clay. Shale or slate bedrock at depths of 3 to 15 feet.

Mica flakes are abundant throughout the soil, and a few cobblestones occur in places. The fertility is not high, and the organic-matter content is low. The reaction is strongly acid. The upper 20 or 24 inches is permeable, but the compact material below retards percolation. Natural drainage is moderately good, or adequate for most

crops commonly grown. The more sandy parts are a little droughty for crops late in summer, but moisture relations are generally favorable. Tilth is good, and the rapid percolation in the surface 20 inches or so makes the soil easy to work over a moderately wide range of moisture content.

Use suitability and management.—Altavista loam has been cleared and cropped; a great part is used for crops and pasture. It is suited to a wide variety of crops and is not difficult to maintain against erosion. Moderately heavy fertilization is required, but the soil responds well to good management. It is easily worked, and the smoother parts can be used intensively for row crops. The more exacting legumes and grasses require lime and phosphorus. Red clover may be a better legume than alfalfa on some of the acreage because of the slow internal drainage of the deep subsoil. For the same reason, tobacco and some truck crops may not be so well suited as small grains and hay crops. In the section on Use and Management of Soils this loam is discussed under group 5.

Ashe loam, steep phase (25–60% slopes) (AK).—Practically all of this soil is on the steep slopes of the ridge along the North Carolina State boundary. It is a yellowish well-drained very friable soil, shallow to micaceous rocks. It is associated with narrow strips of the hilly phase of Ashe loam on the ridge tops and with extensive areas of Stony rough land (Ashe soil material) in the Stony land-Ashe soil association.

Profile description:

0 to 6 inches, dark yellowish-brown, pale-brown, or grayish-yellow loam.
6 to 18 inches, yellow or yellowish-brown sandy clay loam, very friable with little firmness; partly disintegrated olive-gray micaceous rock at depths of ½ to 2 feet.

Rock fragments of various sizes are common in many places and may be sufficiently large and numerous to prohibit cultivation. There are some rock outcrops.

Natural fertility and organic-matter content are low, and the reaction is strongly acid. The entire soil is friable, and internal drainage is medium to rapid. The moisture-holding capacity is not high, because of the shallow depth to bedrock. The cooler climate of the high mountain positions occupied by this soil is more favorable for maintaining good moisture relations than is the warmer climate of the lower lying part of the county.

Use suitability and management.—The greater part of this steep phase is under cut-over deciduous forest with some intermixed pine. The cleared acreage is used for pasture or is idle. Remote location, strong slope, and shallowness to bedrock make the use of this soil for crops impractical. Under usual conditions it is best used for forest, but if required for grazing it is capable of supporting good quality pasture after it has been adequately fertilized and properly seeded. The carrying capacity, especially of the shallower areas on the south-facing slopes, is not high. Use and Management are discussed in group 19 in the section on Use and Management of Soils.

Ashe loam, hilly phase (12–25% slopes) (AH).—Practically all of this yellowish, well-drained, very friable soil has developed over the micaceous rocks of the mountains. It occupies the ridge top along the North Carolina State boundary in association with steeper soils

of the Ashe series and extensive areas of Stony rough land (Ashe soil material). It is in the Stony land-Ashe soil association.

The surface 6 or 8 inches is dark yellowish-brown, pale-brown, or grayish-yellow loam, below which is yellow or yellowish-brown sandy clay loam, very friable with a little firmness. Partly disintegrated olive-gray micaceous rock is at depths of 1 to 3 feet. Some areas are nearly free of stone; others have rock fragments in numbers sufficient to interfere with cultivation. Some areas contain rock outcrops.

This soil is low in fertility and organic matter and strongly acid. It has good tilth and, except in areas less than 12 to 16 inches deep to bedrock, a fairly good capacity for holding moisture available to plants. The cool climate of the high altitude at which this soil occurs tends to maintain better moisture relations through the summer than is common for soils on lower positions in the county.

Use suitability and management.—Most of the acreage is in cut-over deciduous forest. Many areas are suited to small grains, hay, and pasture, and the less steep, deeper parts to such truck crops as beans, cabbage, and potatoes. Nevertheless, the soil is too remotely located for production of crops. Under present conditions it is best used for forest. Group 13 in the section on Use and Management of Soils describes management for this soil.

Ashe loam, hilly dark-colored phase (12–25% slopes) (Ag).—Darker color and higher content of organic matter in the surface layer are the chief differences between this soil and Ashe loam, hilly phase. It is a well-drained soil on the high mountain ridges that developed from micaceous rocks—granite, gneiss, and schist. Practically all of it occurs on the ridge top along the North Carolina-Tennessee State line in association with steep Ashe soils and Stony rough land (Ashe soil material) in the Stony land-Ashe soil association.

Profile description:

0 to 8 inches, brown to dark-brown mellow loam; in uncultivated areas upper 3 or 4 inches is very dark brown.
8 to 28 inches, dark yellowish-brown very friable loam or silt loam that is lighter colored in the lower part.
28 to 40 inches, pale-yellow or yellowish-brown friable but moderately firm silty clay loam; partly distintegrated micaceous rock lies at depths of 1½ to 3½ feet.

The surface 28 inches is a silt loam in some places. Rock fragments are common in some locations, and there are a few outcrops.

This is a moderately fertile soil. The surface 8 inches has a moderately high content of organic matter. The reaction is strongly acid. Tilth is good, internal drainage is moderate, and water-holding capacity is high. The cool climate characteristic of the high ridges favors good moisture relations throughout the entire growing season, but this season is shorter than that in the valleys.

Use suitability and management.—About two-thirds of this soil is in native forest. The rest is used largely for pasture, corn, wheat, potatoes, and some truck crops. Some fertilization is practiced, and yields are moderate. This phase is suited to crops and pasture, but care is required to control erosion on the stronger slopes. The good tilth and loamy nature give a wide range of moisture conditions for cultivation, but the strong slopes interfere with field operations. Its remote location limits its value for the production of many crops. On most farms, hay, pasture, and small grains are probably the best

suited crops. Substantial fertilization and liming are necessary if the more desirable legumes are grown. For a discussion of use and management, see group 13 of the section on Use and Management of Soils.

Augusta silt loam (0–2% slopes) (AL).—This imperfectly drained soil is in depressions on the low stream terraces or benches. It consists of micaceous alluvium that came from gneiss and granite. The surface is nearly level or concave. The areas are elongated narrow depressions subject to occasional flooding. The water table is near the surface for much of the winter and spring. Some soil material is deposited by high floods. Areas occur on the low stream terraces along the French Broad, Nolichucky, and Pigeon Rivers in the Congaree-State and Staser-Sequatchie soil association and are associated chiefly with the State soil.

Profile description:

0 to 14 inches, dark yellowish-brown friable loam or silt loam.
14 to 24 inches, yellowish-brown firm but friable silty clay loam or sandy clay loam; lower part has some mottling.
24 to 36 inches +, mottled yellow, brown, and gray firm but not compact silty clay loam or sandy clay loam; bedrock or gravel beds are at widely variable depths of 3 to 15 feet or more.

A few spots are poorly drained and have a gray or mottled surface soil. Slow drainage and a seasonally high water table limit the productivity and the range of suitability of this moderately fertile soil. The soil has good tilth when not wet, but periods during which it can be worked are shorter than for better drained soils. It is medium to strongly acid.

Use suitability and management.—Practically all of Augusta silt loam has been cleared and is used for corn and hay grown in short rotations. Some is used for pasture, and a small acreage with the best drainage is in truck crops. Small grains, tobacco, and alfalfa are not grown. The wetness of this soil limits its suitability chiefly to corn, soybeans, and hay and pasture crops. Although more fertile than many better drained soils, it can be expected to respond to proper fertilization and to lime applied for legumes. Its moistness favors its use for midsummer pasture, for vegetation grows and remains palatable for a greater part of the dry season than on most of the higher, better drained soils. For a discussion of use and management, see group 3 in the section on Use and Management of Soils.

Barbourville fine sandy loam (1–7% slopes) (BA).—Alluvium washed from soils underlain by sandy rock, chiefly quartzite and conglomerate, is the parent material for this light-brown well-drained soil. Areas are along intermittent drainways issuing from rough mountainous uplands in which Ramsey soils and stony land types prevail. The areas—long narrow strips cut by meandering drainways—are associated with extensive areas of Ramsey and Jefferson soils.

Profile description:

0 to 10 inches, pale-brown mellow loam or fine sandy loam.
10 to 22 inches, pale-brown to yellowish-brown friable fine sandy loam.
22 inches +, light yellowish-brown sandy loam to clay loam with some gray mottlings below 28 inches.

A few cobblestones or pieces of gravel occur in some places and in others are abundant below a depth of 2 feet. The content of plant

nutrients and organic matter is not high, and the reaction is strongly acid. The depth to bedrock or gravel beds ranges from 2 to 6 feet. Tilth and permeability are good. Moisture relations are favorable, although a few areas are droughty. The soil retains sufficient water for good plant growth throughout much of the growing season.

Use suitability and management.—A great part of this soil is cleared, and areas still under forest are those remotely situated along drains in areas of steep Ramsey soils. Corn, hay, pasture, tobacco, and some truck crops are grown. Smooth surface, permeability, and response to fertilization make this soil well suited to intensive use for such crops. This soil is discussed under group 3 in the section on Use and Management of Soils.

Barbourville silt loam (1–9% slopes) (BB).—This brown well-drained soil consists of alluvium from the shaly silt loam Ramsey soils. It occupies narrow strips in the draws and drainways where areas of those soils occur. Small bodies of Barbourville soil along the larger drainways are subject to flooding, and much of the soil receives some accumulation of material, such as drift or local alluvium, from the adjacent higher lying steep slopes. Areas of this gently sloping soil are widely distributed throughout the Ramsey (silt loam)-Hamblen soil association.

Profile description:

0 to 8 inches, yellowish-brown to dark yellowish-brown silt loam.
8 to 35 inches, yellowish-brown friable silt loam or silty clay loam, more yellowish in the lower part; splotches of gray and brown may occur below the yellowish-brown material.

Many fine slate fragments give the soil a soapy feel when wet. Bedrock slate is 3 to 6 feet below the surface. The soil is permeable and has good tilth. It retains moisture well, is moderately fertile, and is moderately to strongly acid.

Use suitability and management.—A great part of Barbourville silt loam has been cleared. Most of the cleared area is cropped and the rest is in permanent pasture. Corn, tobacco, and hay are the most important crops. The range of suitability is wide. Most areas can be farmed intensively, as the soil has a smooth surface and is permeable and responsive to proper management. Corn, tobacco, truck crops, red clover, orchard grass, and the more desirable pasture legumes and grasses do well. Alfalfa is suited to the higher lying areas if they are adequately fertilized. This soil is needed for intensive use, especially for corn and cash crops, as the acreage suitable for such use is very limited on most farms. For a discussion of use and management, see group 3 in the section on Use and Management of Soils.

Barbourville stony fine sandy loam (1–7% slopes) (BC).—The parent material of this well-drained stony soil located along drainways is alluvium derived largely from Ramsey soils. It differs from Barbourville fine sandy loam chiefly in having cobbles and gravel throughout that greatly impede tillage. Much of the acreage is in narrow strips along drainways within extensive areas of steep Ramsey soils.

Profile description:

0 to 10 inches, pale-brown mellow loam or fine sandy loam containing many cobblestones and pieces of gravel.
10 to 18 inches, pale-brown to light yellowish-brown loose sandy loam containing many cobblestones and pieces of gravel.

18 inches + light yellowish-brown loose sandy loam containing an abundance of cobblestones and gravel.

Beds of cobblestones may be within 1½ to 3 feet of the surface, and bedrock quartzite or slate is within 3 to 6 feet in most places. The soil is permeable, and moisture relations in most areas are favorable. Organic-matter content and plant-nutrient supply are not high, and the reaction is strongly acid.

Use suitability and management.—Much of this soil is cleared, and some is used for corn, potatoes, and garden crops. The greater part is in unimproved pasture. Lime has been applied, and some fertilization is practiced for row crops. The stone content makes it impractical to use heavy machinery in most places, but many areas can be worked by hand or with light implements—especially after the larger rocks have been removed. Crops requiring cutting, such as small grains and hays, are not suited unless this operation is done by hand. Corn, potatoes, and truck crops are fairly well suited to this soil, and all areas are capable of producing good pasture if adequately fertilized. Group 3 in the section on Use and Management of Soils describes management for this soil.

Buncombe loamy fine sand (1–3% slopes) (Bd).—Much of the material for this very sandy soil of the first bottoms or flood plains along the larger streams (chiefly the French Broad, Nolichucky, and Pigeon Rivers) originated from micaceous rocks. The areas occur as natural levees adjacent to the stream channels. The soil is slightly higher than the associated soils of bottom lands, and its surface is gently undulating or billowy. All of the soil is subject to flooding, and all of it is of the Congaree-State soil association. About 294 acres were inundated by the Douglas Reservoir.

Profile description:

0 to 12 inches, grayish-brown to dark grayish-brown loose loamy fine sand.
12 to 36 inches +, light yellowish-brown, grading to pale yellow, loose loamy fine sand or fine sand.

Bedrock lies 5 to 15 feet below the surface. Mica occurs throughout the soil in most places.

This soil is low in fertility and organic matter and is medium acid. It has a very low moisture-holding capacity, but is very permeable to roots. The water table is at depths of 5 to 8 feet. Some areas are subject to damage by scouring or by deposition of coarse sediments.

Use suitability and management.—A large part of Buncombe loamy fine sand is used for corn, vegetables, tobacco, and melons—crops that do well on loose, open soil. A small acreage is used for pasture, but the pastures soon dry during droughts. Sod crops are not so well suited. Some fertilizer is used, especially for vegetables and melons. Barnyard manure is also applied to these crops. Heavy fertilization is required for good yields, and it is thought best to apply small quantities frequently. The soil is easy to work but is so loose and sandy that heavy machinery is difficult to manipulate. Weeds are notably less difficult to control than on the more fertile soils of the bottom lands. For a discussion of use and management, see group 2 in the section on Use and Management of Soils.

Camp silt loam (2–7% slopes) (Ca).—This light-red or purplish soil consists of local alluvium from Teas soils. The parent rock is purplish or dusky-red shale, parts of which are calcareous. Areas

are on gently sloping alluvial fans and along drainways adjacent to areas of Teas soils. This well-drained soil is in the Teas-Stony land soil association.

Profile description:

0 to 6 inches, reddish-brown (moist) or light-red (dry) silt loam.
6 to 18 inches, reddish-brown (moist) or light-red (dry) silty clay loam.
18 inches +, weak reddish-brown moderately firm silty clay loam containing some shale fragments; bedrock shale at depths of 3 to 7 feet.

Shale fragments, though not abundant, are common throughout much of this moderately fertile soil. Tilth is good, although clay content causes the soil to clod or bake more easily than soils such as the Ramsey, Dandridge, and Barbourville. This soil is moderately permeable, retains moisture for plants moderately well, and has a medium acid reaction. Erosion is a hazard only on the higher lying more sloping areas.

Use suitability and management.—Most of Camp silt loam is cleared and in corn and hay, but a small acreage in narrow draws, within areas of steep Teas soils, is still in native forest. This soil is well suited to most of the general farm crops, including alfalfa and tobacco. Root crops, such as potatoes, can be grown, but the fairly heavy nature of much of the material makes them less well suited. Because of its smooth surface and response to good management, the soil can be intensively cultivated. For a discussion of use and management, see group 3 in the section on Use and Management of Soils.

Chewacla fine sandy loam (0–2% slopes) (Cb).—This imperfectly drained soil occurs on the bottom lands along streams and consists of alluvium that originated largely from micaceous rocks. Most areas are along the Nolichucky and French Broad Rivers in the Congaree-State soil association. They lie in gentle depressions on nearly level positions associated with Congaree and Buncombe soils and are among the first soils to be flooded by high water. The Douglas Reservoir has inundated 489 acres.

Profile description:

0 to 18 inches, pale-brown to very dark-brown fine sandy loam; plow soil is usually darker than the rest of the layer.
18 to 36 inches +, mottled brown, yellow, and gray loam or fine sandy loam; firmer than surface layer and more predominantly gray with depth; bedrock at depths of 5 to 15 feet.

This moderately fertile soil has a fair content of organic matter. It is medium to strongly acid. Tilth is good, but slow internal drainage delays tillage operations following wet periods in spring. The susceptibility to flooding is a hazard to crops. The soil is permeable to roots and maintains adequate moisture for plants through a great part of the growing season.

Use suitability and management.—Practically all of this soil is used for crops (chiefly corn and hay) and pasture. Some fertilization is practiced, and good yields are obtained. The moderate fertility and abundant moisture supply make pasture, hay, and such moisture-tolerant crops as corn and soybeans well suited. The soil requires lime for the legumes and grasses if high yields are to be obtained. Under proper management productivity for the adapted crops is easily maintained. Group 1 in the section on Use and Management of Soils describes management for this fine sandy loam.

Congaree fine sandy loam (0–2% slopes) (Cc).—This is a well-drained to somewhat excessively drained brown sandy soil on the first bottoms. It consists of alluvium that came mainly from micaceous rocks. It is associated with Chewacla, Wehadkee, Buncombe, and other Congaree soils in areas of the Congaree-State and Staser-Sequatchie soil association. It is on bottom lands along the French Broad, Nolichucky, and Pigeon Rivers. It differs from the Buncombe soil in having sufficient clay to be a fine sandy loam rather than a loamy fine sand. The surface is nearly level, and the soil is subject to overflow. Approximately 576 acres have been inundated by the Douglas Reservoir.

Profile description:

0 to 20 inches, brown friable fine sandy loam, darker in the upper 5 or 6 inches.
20 to 30 inches, yellowish-brown very friable fine sandy loam.
30 inches +, yellow friable fine sandy loam mottled with gray and brown; bedrock ranges from 5 to 15 feet below the surface.

In places the soil is free of mottlings to 40 inches. In some areas the texture below 28 inches is sandy clay loam or clay loam.

Occasional flooding helps to maintain the fertility of this soil. It is medium acid and fair in content of organic matter. Tilth is good, and the soil is permeable. Although its capacity for holding moisture is lower than for some soils, its permeable nature favors deep root development and moisture relations suitable for all except the shallow-rooted grasses.

Use suitability and management.—Friability, permeability, smooth surface, and response to fertilization make Conagree fine sandy loam very desirable for many truck crops and tobacco. It is used chiefly for these crops and for corn, and yields are high. Practically all crops commonly grown are suited, although there are several soils that probably are more desirable for sod crops. Small quantities of fertilizer are used for corn, but fairly large applications are given tobacco and truck crops. Under proper management, high productivity is easily maintained, even under intensive use. For a discussion of use and management, see group 1 in the section on Use and Management of Soils.

Congaree loam (0–2% slopes) (Cd).—Texture is the chief difference between this soil and Congaree fine sandy loam. The color is a little darker, and the depth to mottling is a little less. The surface is nearly level, and all areas are subject to overflow. The areas, ranging from 10 to 50 acres in size, are widely distributed on bottom lands along the French Broad, Nolichucky, and Pigeon Rivers in the Congaree-State and Staser-Sequatchie soil association. About 307 acres were inundated by the Douglas Reservoir.

This is one of the most fertile soils in the county; material deposited during overflows helps to maintain its productivity. The soil is permeable and has good internal drainage. Good tilth and a smooth surface make it easy to work. The reaction is medium acid. The soil has good water-holding capacity, and moisture relations are normally very favorable for the crops commonly grown.

Use suitability and management.—Since it is productive and easily worked and conserved, this soil is well suited to intensive use. It is suited to practically all the crops commonly grown, including the more exacting legumes if they are moderately limed. Corn, tobacco, and

truck crops are the chief crops, and a small acreage is in hay and pasture. Little fertilizer is used for corn and hay crops, but the cash crops (tobacco and truck) receive heavy applications. Yields are high. Floods are a hazard, especially to high-value crops such as tobacco, cabbage, and beans. Use and management are described under group 1 in the section on Use and Management of Soils.

Cotaco fine sandy loam (0–3% slopes) (Ce).—Poorer internal drainage chiefly differentiates this soil from Barbourville fine sandy loam. It is an imperfectly drained sandy soil consisting of alluvium derived from sandy Ramsey soils. It occurs as narrow strips along drainways; much of it is closely associated with extensive areas of the steep Ramsey soils. The surface is nearly level to gently sloping, and small parts are subject to overflow.

Profile description:

0 to 18 inches, light brownish-gray loam or fine sandy loam.
18 inches+, mottled light-gray, pale-yellow, and brown fine sandy loam or fine sandy clay loam.

Bedrock slate or quartzite is at depths of 2 to 6 feet, and a few cobblestones and pieces of gravel occur in places. In some areas the mottling is at a shallower depth. A few higher lying patches of Barbourville soils, too small to map separately, are included with this soil. These areas are free of mottling to depths of 2 to 3 feet.

Cotaco fine sandy loam is moderately fertile but low in organic-matter content. It is medium to strongly acid, permeable, and good in tilth relations. Its relatively high water table—within 2 feet of the surface much of the time—interferes with root development.

Use suitability and management.—Slow internal drainage restricts the range of crops to which this soil is suited. Its smooth surface and good tilth make it well suited to intensive use; and inasmuch as most of it is on farms that have a limited acreage of cropland, it is especially valuable for row crops. It is used to advantage for corn, lespedeza, orchard grass, sorghums, and permanent pasture of legumes and grasses. Alfalfa, potatoes, and other root crops are not so productive unless the soil is artificially drained. Some areas along the narrower drainways in the more remote sections are still forested. See group 3 in the section on Use and Management of Soils for further information on management of Cotaco fine sandy loam.

Cumberland silty clay loam, eroded undulating phase (2–12% slopes) (Cf).—Areas on the high stream terraces with the darkest brown color are represented by this soil. It consists of old mixed alluvium, apparently strongly influenced by limestone. It differs from the Waynesboro soils chiefly in having a darker brown surface soil and a redder, finer textured subsoil. All areas are in the Waynesboro-Nolichucky-Dunmore soil association. Most of the soil is eroded to the extent that the plow layer now consists of a mixture of original surface soil with subsoil material.

Profile description:

0 to 5 inches, dark-brown to very dark-brown friable silty clay loam.
5 to 16 inches, yellowish-red friable silty clay loam.
16 to 36 inches, red or dark brownish-red firm but friable silty clay loam grading to silty clay; material is variable below this layer; it may consist of an irregular gravelly bed, or it may be firm silty clay or silty clay loam variegated or reticulated with red and yellow; bedrock, in most places limestone, is at depths of 4 to 18 feet.

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Cobblestones and gravel occur in a few places, but are not numerous enough to interfere with cultivation. Small dark concretions are common throughout the subsoil. Practically all areas along the French Broad River have a noticeable content of fine mica flakes. In a few places, where erosion has been less active, the surface soil is thicker and is silt loam rather than silty clay loam.

This is one of the most fertile soils of the county. It has a moderate organic-matter content and is medium acid. Tilth is good but not so open or friable as that of the uneroded Nolichucky loam. Infiltration and internal drainage are moderate, and water-holding capacity is fairly good.

Use suitability and management.—High fertility, good tilth, undulating and rolling slope, and favorable moisture relations make this soil one of the most desirable and widely suited in the county for crops and pasture. Some of the more loamy soils, however, may be preferred for truck crops. Most of the acreage is used for corn, small grains, hay, tobacco, red clover, and alfalfa. Fertilizer is used for most crops, and probably all areas have been limed. Yields are higher than on most soils and can be maintained with good management, including adequate fertilization. Pastures of excellent quality can also be maintained. Erosion control requires special attention during periods of cultivation. For a discussion of use and management, see group 4 in the section on Use and Management of Soils.

Dandridge silt loam, steep phase (25–60% slopes) (DL).—The Dandridge are light-colored shaly soils shallow to calcareous shale bedrock. This phase represents the steep areas that have not been cleared and cropped and therefore have not been subjected to accelerated erosion. It appears that the better or deeper areas of the Dandridge soils were cleared first and that the areas still under native forest represent the less desirable ones that are shallow to bedrock. The Dandridge soils and the Dandridge and Litz complexes occupy the "knobs" section of the county, a hilly and steep belt extending in a northeast-southwest direction across the county northwest of Newport. The areas are widely distributed in this section in the Dandridge-Leadvale-Hamblen and Steep Dandridge-Whitesburg-Hamblen soil associations.

Profile description of Dandridge silt loam, steep phase:

0 to 5 inches, grayish-brown or light brownish-gray silt loam containing shale fragments in many places.

5 to 18 inches, pale-yellow to gray moderately compact but friable shaly silty clay or silty clay loam; calcareous shale bedrock at depths of 8 to 24 inches.

The subsoil is more silty in places. Shaly material outcrops in spots. The bedrock in some areas is a little sandy, and here the surface layer contains some sand. In some places the shale bedrock has been leached of its lime and the depth to calcareous rock is ¾ to 2 feet.

Shallowness to bedrock limits the water-holding capacity of the soil. The north-facing slopes are generally less droughty than those facing south. The natural fertility is not high, and the reaction varies greatly, depending on the depth to calcareous rock. Where lime is at very shallow depths, the soil may not be acid. Where it is at a considerable depth, the soil is medium to strongly acid.

Use suitability and management.—Because of strong slope and shallow depth to bedrock, this soil is poorly suited to crops. Practically all of it is under forest. Since bluegrass and white clover develop a good stand under favorable conditions, the more productive areas will support a moderate growth of good quality pasture. The best locations for pasture are the deeper parts of the north-facing slopes. Areas on the south-facing slopes that are shallow to bedrock probably are best used for forest. For a discussion of use and management, see group 17 of the section on Use and Management of Soils.

Dandridge silt loam, hilly phase (12–25% slopes) (DJ).—A less steep slope is the chief difference between this soil and the steep phase of Dandridge silt loam. This hilly soil is usually on narrow strips of smoother land on ridge crests. Surface drainage is excessive, and internal drainage moderate. The underlying rock consists chiefly of calcareous shale, but thin layers of calcareous sandstone are interbedded in places. The most closely associated soils are other members of the Dandridge series and, to a much less extent, the Leadvale, Whitesburg, and Hamblen soils of the adjacent colluvial and alluvial lands. All areas of this soil are in the Dandridge-Leadvale-Hamblen and Steep Dandridge-Whitesburg-Hamblen soil associations.

Profile description:

0 to 6 inches, grayish-brown or light brownish-gray silt loam; shale fragments common in places.
6 to 20 inches, pale-yellow to gray moderately compact shaly silty clay or silty clay loam; calcareous shale bedrock at depths of 9 to 30 inches.

The subsoil is more silty in places. Shaly material outcrops in a few places. Where the bedrock contains some sand, the soil is somewhat sandy. In some areas the bedrock has been leached of lime and the depth to calcareous rock is from ½ to 2 feet.

Shallowness to bedrock limits the moisture-holding capacity. There is less difference in the productivity of the north- and south-facing slopes than for the steep phases of Dandridge silt loam and shaly silt loam, but those facing north can be expected to have better moisture relations and higher productivity. The natural fertility is not high, and the reaction varies from neutral to medium acid.

Use suitability and management.—Practically all of the hilly phase is under cut-over hardwood forest. Because of its shallow depth to bedrock and strong slope, it is poorly suited to crops. Under proper management, however, it can be used for long crop rotations consisting of small grains, hay, and pasture. The more shallow areas, especially on the south-facing slopes, are droughty; but most areas are suited to bluegrass and white clover if well managed. Group 17 in the section on Use and Management of Soils gives management for this soil.

Dandridge silt loam, rolling phase (2–12% slopes) (DK).—A smoother surface is the chief difference between this soil and the steep phase of Dandridge silt loam. It is a light-colored shaly soil shallow to calcareous shale bedrock. Most of it occurs on low gentle ridges below the general elevation of the steeper Dandridge soils, though a small acreage is on narrow ridge crests, the slopes of which are occupied by steeper Dandridge soils. This soil is in the Dandridge-Leadvale-Hamblen association.

Profile description:

0 to 6 inches, grayish-brown or light brownish-gray silt loam containing shale fragments.
6 to 20 inches, pale-yellow to gray moderately compact shaly silty clay or silty clay loam. Calcareous shale bedrock lies below depths of 9 to 30 inches.

In places the bedrock has been leached of lime and the depth to calcareous rock is ½ to 2 feet. Shallowness to bedrock limits the moisture-holding capacity, and the fertility is not high. The reaction ranges from neutral to medium acid. Because of the thin layer of soil material, the soil is easily damaged by erosion. The shale interferes with tillage.

Use suitability and management.—Little of this soil has been cleared and cropped. It can be used for crops, but its suitability and productivity are limited. Small grains and legumes and grasses for hay or pasture are among the better suited crops; truck crops, such as potatoes, and long-season crops are among those less well adapted. See group 12 in the section on Use and Management of Soils for a discussion of management requirements.

Dandridge silt loam, very steep phase (60+% slopes) (DM).—This very steep soil is shallow to calcareous shale. It differs from the steep phase chiefly in having even a steeper slope. The depth to bedrock is thought to average less than for the steep phase, and outcrops of shale are common. The grayish-brown or brownish-gray silt loam soil material ranges from 6 to 18 inches deep. Shale fragments are numerous in the lower part and in places occur throughout the soil. The content of plant nutrients and organic matter is low, and the reaction is slightly alkaline to neutral. Moisture percolates through the soil, but the shallow depth to bedrock causes runoff to develop quickly. The capacity for holding moisture is small, and the south-facing slopes are especially droughty. Areas occur as narrow strips on the strongest slopes of ridges in the Dandridge-Leadvale-Hamblen association.

Use suitability and management.—Because of the very strong slope and shallow depth to bedrock, this soil is poorly suited to crops and pasture. All of it is in cut-over deciduous forest and should remain forested. For a discussion of use and management, see group 19 in the section on Use and Management of Soils.

Dandridge shaly silt loam, eroded steep phase (25–60% slopes) (DI).—In this phase are former areas of steep Dandridge silt loam that have lost considerable material as a result of erosion. The plow layer consists of light brownish-gray or yellowish-gray shaly silt loam; the subsoil is pale-yellow to gray moderately compact shaly silty clay or silty clay loam. Calcareous shale bedrock is 6 to 18 inches from the surface. The subsoil is more silty and shaly in some places. The bedrock in some areas is a little sandy, and in those the surface layer contains some sand. In some areas, the shale bedrock has been leached of its lime and the depth to calcareous rock is ½ to 1¾ feet.

This is the most extensive Dandridge soil. It is widely distributed throughout the Dandridge-Leadvale-Hamblen and Steep Dandridge-Whitesburg-Hamblen soil associations northwest of Newport. It occupies a major part of the landscape and is associated with Ham-

blen and Whitesburg soils in the draws and on bottom lands and with narrow strips of less steep Dandridge soils on the ridge crests.

Shallowness to bedrock limits the water-holding capacity. The natural fertility is not high, and the reaction depends on the depth to calcareous rock. Where lime is nearer the surface, the soil may not be acid; where it is at a considerable depth, the soil is medium to strongly acid.

Use suitability and management.—All of the acreage has been cleared. About 20 percent is used for row crops, chiefly corn; most of the rest is in pasture. Little fertilization is practiced, and yields are low. Pasture on the more favorable sites is fairly good, but the vegetation in most places consists of such scrubby and weedy growth as briers, sassafras, persimmon, and broomsedge. Because of the strong slope and shallow depth to bedrock, this soil is poorly suited to crops. Bluegrass and white clover develop a good stand under favorable conditions, and the more productive areas are capable of supporting a moderate quantity of good quality forage. The best pasture land is on the north-facing slopes. On many farms the more eroded south-facing slopes probably are best used for forest. See group 17 in the section on Use and Management of Soils for further information on management of this soil.

Dandridge shaly silt loam, eroded hilly phase (12–25% slopes) (Dg).—Areas of the hilly phase of Dandridge silt loam that have lost considerable soil through erosion are represented by this phase. The plow layer consists of light brownish-gray or yellow-gray shaly silt loam; the subsoil is pale-yellow to gray moderately compact but friable shaly silty clay loam or silty clay. Calcareous shale bedrock is at depths of 6 to 24 inches. Where the subsoil or bedrock shale is exposed, the plow layer is very shaly. In places where the bedrock contains some sand, the soil profile is a little more sandy. In some areas the shale bedrock has been leached of its lime and calcareous rock is ½ to 2 feet below the surface. Gullies 1 to 2 feet deep are common in some areas.

The soil is widely distributed throughout the Dandridge-Leadvale-Hamblen and Steep Dandridge-Whitesburg-Hamblen soil associations. Much of it is on ridge slopes, with areas of smoother Dandridge soils on the ridge crests, and with Whitesburg or Hamblen soils in the draws and on the bottom lands.

The reaction is mostly slightly acid or neutral, but it is medium or strongly acid where the bedrock is leached of lime to some depth. Natural fertility is not high, and tilth of the plow layer varies. The less eroded areas have good tilth; the more severely eroded ones have poor tilth because of the shale fragments, very shallow depth, outcrops of bedrock, and the heavy nature of the soil material. The moisture-holding capacity is limited, and the more exposed areas are droughty.

Use suitability and management.—All of this soil has been cleared and used for crops and pasture. A large part is now in unimproved pasture, some is used for crops, and an appreciable part is idle. Crops are poorly suited because of the shallow depth to bedrock and the strong slope. Areas that must be cropped are best suited to small grains and hay. Pasture yields are fair to good under good management. For a discussion of use and management, see group 17 in the section on Use and Management of Soils.

Dandridge shaly silt loam, eroded rolling phase (2–12% slopes) (DH).—The loss of much soil material through erosion differentiates this soil from the rolling phase of Dandridge silt loam. The plow layer consists of light brownish-gray or yellowish-gray shaly silt loam or silty clay loam. Shale bedrock is at a shallow depth. In the most severely eroded areas it may be nearly at the surface; in the smoother, less eroded ones, 24 inches below the surface. Where the soil material is 12 inches or more thick, the subsoil is pale-yellow moderately compact shaly silty clay loam. The most severely eroded areas, where not cultivated regularly, have some shallow gullies that make tillage very difficult or impossible, but they are smoothed by disrupting the underlying shale. The most extensive acreage of this phase is along the southeastern edge of the Dandridge-Leadvale-Hamblen soil association in the vicinity of Parrotsville. Other narrow winding strips occur on ridge tops throughout this association.

Use suitability and management.—Much of this eroded rolling phase is now used for corn, lespedeza, and other general farm crops; some of it is in pasture of poor quality; and some is idle with an uneven cover of sassafras, broomsedge, and briers.

Although this soil is considered suited to crops, the more severely eroded parts are capable of producing pasture only if they are substantially fertilized and properly seeded. Hay, pasture, and small grains are among the better crops; truck and long-season crops are unproductive. See group 12 in the section on Use and Management of Soils for management of this phase.

Dandridge and Litz silt loams, steep phases (25–60% slopes) (DE).—This is a complex—steep areas of Dandridge and Litz soils in intricate association that were mapped together. The Dandridge areas are similar to Dandridge silt loam, steep phase; they consist of yellowish-gray shaly silt loam underlain at 8 to 24 inches by calcareous shale. The Litz areas consist of 6 or 8 inches of yellowish-gray silt loam underlain by brownish-yellow moderately plastic silty clay or silty clay loam that is splotched with red, gray, and brown in the lower part. Brownish and yellowish soft shale is at depths of 14 to 30 inches. This shale material is acid, but in most places calcareous shale is at ¾ to 3 feet.

The natural fertility is moderate, and the organic-matter content is low. Areas with calcareous shale at a shallow depth (the Dandridge areas) have adequate lime for plants, though the surface layer may be acid. Areas that have leached shale to a depth of several feet are medium to strongly acid. Internal drainage is good, but runoff is very rapid. Moisture-holding capacity varies with the depth to bedrock—the shallower areas on the south-facing slopes are the most droughty; the deeper areas on the north-facing slopes have the most favorable moisture relations. Tilth is good, but shale fragments interfere with cultivation in places. Areas of this complex are widely distributed throughout the Steep Dandridge-Whitesburg-Hamblen soil association, but they are not numerous.

Use suitability and management.—Practically all of this complex is in cut-over hardwood forest. It is poorly suited to crops because of steep slopes and shallowness to bedrock. It is capable of supporting some permanent pasture but is probably better as forest land. For a discussion of use and management, see group 17 in the section on Use and Management of Soils.

Dandridge and Litz silt loams, hilly phases (12–25% slopes) (Dc).—This complex consists of well-drained to excessively drained soils, shallow to shale, that are calcareous in some places and acid in others. It differs from the complex of steep phases chiefly in slope and in greater depth to bedrock. The areas occur in the Steep Dandridge-Whitesburg-Hamblen and Dandridge-Leadvale-Hamblen soil associations.

Use suitability and management.—Because of the shallowness to bedrock and strong slope, this complex is poorly suited to crops. Under very careful management the deeper areas can be used in long rotations consisting chiefly of grass-and-legume hay and small grains. Permanent pasture of bluegrass, orchard grass, and white clover is suited where good management is practiced. Group 17 in the section on Use and Management of Soils recommends management practices for this complex.

Dandridge and Litz silt loams, rolling phases (5–12% slopes) (Dd).—More gentle slope distinguishes this complex from the complex of steep phases. It consists of an 8- to 24-inch layer of yellowish-gray shaly silt loam, underlain in some places by acid leached shale and in others by calcareous shale. Some areas have a pale-yellow or yellowish-brown firm silty clay or silty clay loam subsoil below a depth of 6 inches and bedrock at 30 to 36 inches. The subsoil is reddish yellow in a few places. Some areas contain a noticeable quantity of fine sand—the surface soil is loam; the subsoil, firm but crumbly sandy clay loam.

Fertility and organic-matter content are low. The reaction varies from medium acid to alkaline, depending on the depth to calcareous shale. Internal drainage is moderate, but the shallow depth to bedrock causes rapid runoff. The shale, however, interferes less with percolation than limestone bedrock. The moisture-holding capacity is fair, and those areas where shale is within a few inches of the surface are decidedly droughty.

Areas occur as narrow strips on high ridges, the slopes of which are occupied by hilly or steep Dandridge and Litz soils. They are widely distributed throughout the Steep Dandridge-Whitesburg-Hamblen and the Dandridge-Leadvale-Hamblen soil associations.

Use suitability and management.—Shallowness to bedrock limits the productivity of this complex and it is difficult to work where the shale is very near the surface. It is capable of producing fairly good yields of small grains. Good stands of grass-and-legume hay or pasture can be maintained, but their development during drier parts of the growing season is greatly restricted by lack of moisture. Most of the acreage is in cut-over deciduous forest. For a discussion of use and management, see group 12 of the section on Use and Management of Soils.

Dandridge and Litz silt loams, very steep phases (60+% slopes) (Df).—This complex is the most extensive of the complexes of Dandridge and Litz soils. These soils have thin surface layers of grayish-yellow shaly silt loam. Shale bedrock is mostly at depths of 6 to 18 inches but outcrops in some places. The rocks under the Dandridge soils are calcareous; those under the Litz soils are mostly acid. Fertility and moisture-holding capacity are low, and runoff is very rapid.

Areas occur as moderately wide strips, some of which extend for

a considerable distance along the sides of some of the highest ridges in the Steep Dandridge-Whitesburg-Hamblen soil association. Small areas are in the Dandridge-Leadvale-Hamblen soil association.

Use suitability and management.—Nearly all of this complex is in cut-over deciduous forest. Small parts are cleared and used for pasture, but the carrying capacity is low. Because of the very strong slope and shallow depth to bedrock, this complex is very poorly suited to crops or pasture. Where good vegetative cover is not maintained or where cattle do much trampling, pastures are subject to erosion. In general, slopes facing south are more droughty than those facing north, and pastures or trees grow better on the north slopes. Group 19 of the section on Use and Management of Soils recommends management practices for this complex.

Dandridge and Litz shaly silt loams, eroded steep phases (25–60% slopes) (DB).—Areas of the steep phases of Dandridge and Litz shaly silt loams that have been cleared and have lost much soil by erosion are represented in this complex. The plow layer for much of the complex consists of light brownish-gray shaly silt loam. In places, however, much soil material has been lost and shale bedrock is at or within a few inches of the surface. Where bedrock is near the surface the plow layer is very shaly. Areas occupy steep ridge slopes throughout the Steep Dandridge-Whitesburg-Hamblen and Dandridge-Leadvale-Hamblen soil associations.

Natural fertility is not high, organic-matter content is low, and internal drainage is good. Moisture-holding capacity varies—deeper parts on the north-facing slopes have fairly good moisture relations; the shallower parts on south-facing slopes are droughty. Tilth is good in the less eroded parts and fair where the silty clay loam subsoil has been exposed and now forms the plow layer. In many places shale seriously interferes with tillage.

Use suitability and management.—All of this complex has been cleared and cultivated. Much of it is used for pasture, and a very small area for crops. A small acreage has reverted to forest. Pastures are not improved; broomsedge and brushy growth prevail in many places, and under average conditions the carrying capacity is low. Bluegrass develops a fair stand in places. Orchard grass, white clover, and bluegrass are not difficult to establish and maintain on these soils and would supply good grazing with proper management. Crops are very poorly suited because of steep slope and shallow depth to bedrock. The shallower, more droughty areas are probably best use for forest. For a discussion of use and management, see group 17 in the section on Use and Management of Soils.

Dandridge and Litz shaly silt loams, eroded hilly phases (12–25% slopes) (D).—Well-drained to excessively drained shallow soils formed from shale constitute this complex. It differs from the complex of eroded steep phases of Dandridge and Litz shaly silt loams in slope and in erosion. In the less eroded areas, only the greater part of the original surface soil has been removed and the plow layer is light brownish-gray shaly silt loam or silty clay loam. Below the plow layer is brownish-yellow moderately plastic but somewhat friable silty clay loam containing a variable quantity of shale. Shale bedrock, calcareous in some places and acid in others, is at ½ to 2½ feet. The more eroded areas have lost much subsoil as well as surface

soil material, and the plow layer is brownish-yellow very shaly silty clay loam. The shale bedrock is at or near the surface in many places. Small gullies are common in some of the more eroded areas. This fairly extensive complex is widely distributed throughout the Steep Dandridge-Whitesburg-Hamblen and Dandridge-Leadvale-Hamblen soil associations.

Fertility is not high, and organic-matter content is low. Reaction of the Dandridge soils ranges from neutral to alkaline where tillage has mixed calcareous shale with the surface material, and that of the Litz soils ranges from neutral to medium acid where there is a fair thickness of soil material over acid shale. Tilth is fair to good, depending on the quantity of silty clay loam or silty clay subsoil material that has been mixed into the plow layer. The water-holding capacity varies from low where shale is at or near the surface to medium in the deeper areas. The north-facing slopes generally have better moisture relations than south-facing positions, but the difference probably is not so great as for the complex of eroded steep phases.

Use suitability and management.—All areas of these eroded hilly phases have been cleared and cropped. Much of the acreage is in pasture, part is used for corn, hay, and small grains, and a considerable area is idle or abandoned. Crops are not well suited because of strong slope and shallow depth to bedrock. Under careful management, however, the less eroded areas may be used for long crop rotations consisting of small grains and grass-and-legume hay or pasture. Permanent pasture supports a good stand of bluegrass and white clover under good management. See group 17 of the section on Use and Management of Soils for a discussion of management practices.

Dandridge and Litz shaly silt loams, eroded rolling phases (5–12% slopes) (Da).—Most of this complex contains much shale. In most places it is yellowish-gray shaly silt loam. Areas with sufficient depth to bedrock have a yellowish-brown silty clay loam subsoil and a plow layer similar to the subsoil but with little or no shale. Shale bedrock—at 6 to 30 inches—is calcareous in some places and acid and leached in others.

The content of plant nutrients and organic matter is low. The reaction ranges from medium acid to alkaline, depending on the depth to calcareous shale. The soil material is moderately permeable to moisture, but the low moisture-holding capacity in most places causes droughtiness during the drier parts of the growing season.

Most areas occur as narrow strips on ridge tops, the slopes of which are occupied by hilly and steep Dandridge and Litz soils. Areas are widely distributed throughout the Steep Dandridge-Whitesburg-Hamblen and Dandridge-Leadvale-Hamblen soil associations.

Use suitability and management.—This complex is similar in suitability to the rolling phases complex of Dandridge and Litz silt loams. All of it has been cleared and cultivated at some time. Most of it is used for pasture and hay, but some for small grains and corn. A part is idle. Fertilization is not heavy, and crop yields are low. For a discussion of use and management, see group 12 of the section on Use and Management of Soils.

Dewey silty clay loam, eroded rolling phase (5–12% slopes) (Dp).—A great part of this red soil of the uplands has been materially eroded; the plow layer in most places consists of a mixture of the

original surface soil with subsoil materials. The soil is well-drained, fertile, and deep over limestone bedrock. The surface is undulating to rolling. Areas are widely distributed throughout much of the Dewey-Dunmore soil association.

Profile description:

0 to 6 inches, yellowish-red silty clay loam.
6 to 24 inches, yellowish-red to red firm but friable silty clay.
24 to 48 inches +, splotched red and reddish-yellow firm but somewhat friable silty clay that is lighter colored with depth; limestone bedrock is at 8 to 15 feet in most places.

The yellowish-red surface layer may be 8 to 10 inches thick. The less eroded areas have a dark grayish-brown silt loam surface layer 6 to 10 inches thick. In places the surface layer is brown to dark brown and has a soft or spongy feel. The deeper subsoil material is exposed in some areas, and in these the plow layer is red moderately heavy silty clay of poor tilth.

Naturally fertility is relatively high, organic-matter content is moderate to low, and the reaction is medium to strongly acid. Tilth of most areas is good, but many of the more eroded parts puddle easily when wet and are hard and intractable when dry. Internal drainage is good, but the subsoil is firm enough to retard percolation of moisture. Runoff developing during prolonged rains is a hazard on the more sloping parts if the soil is not protected by close-growing vegetation.

Use suitability and management.—Practically all of this soil has been cleared and cropped (pl. 1, *A*), and most of it is now used for crops and pasture. Very little is idle. Corn, wheat, red clover, tobacco, and alfalfa are the chief crops. Truck crops are suited, but less so than on other more friable open soils, as the Sequatchie, State, and Allen. Rotations lasting 3 and 4 years are used and are well suited, though in some areas row crops are grown more frequently. Some fertilization is practiced.

This productive soil responds well to good management. Pasture of good quality is easily maintained under proper management. See group 6 in the section on Use and Management of Soils for suitable management.

Dewey silty clay loam, eroded hilly phase (12–25% slopes) (Do).—The eroded hilly phase, distributed throughout much of the Dewey-Dunmore soil association, differs from the hilly phase of Dewey silt loam chiefly in erosion. Much of it has lost from one-half to three-fourths of the original surface soil and has a plow layer consisting of reddish-brown silty clay loam. Erosion has removed all of the surface soil and part of the subsoil in some places, and in these the plow layer is now a red to reddish-yellow firm silty clay. These more severely eroded areas are represented on the map by appropriate symbol. Limestone bedrock is at depths of 5 to 12 feet in most places. Erosion has made the plow layer lower in organic matter and less favorable in tilth and permeability.

Use suitability and management.—The soil responds well to good management, and if properly handled it is suited to most general farm crops, including alfalfa, red clover, grasses, and small grains. Row crops cannot be grown frequently, and on many farms permanent pasture is the best use. For a discussion of use and management, see group 10 in the section on Use and Management of Soils.

Dewey silty clay loam, eroded steep phase (25–60% slopes) (DQ).—Slope is the chief difference between this soil and the eroded hilly phase of Dewey silty clay loam. This eroded soil occupies small areas in association with the hilly Dewey soils and Dunmore soils in the Dewey-Dunmore soil association. In areas less eroded, the 6- to 8-inch surface layer is brown to dark-brown silt loam. For most of the acreage, however, the plow layer is reddish-brown silty clay loam underlain by red firm silty clay subsoil. On some cleared areas erosion has been so severe that the plow layer consists of red firm silty clay. Small gullies are common on the severely eroded areas if the surface is not smoothed by frequent tillage. Runoff develops rapidly during rains. Limestone bedrock is at depths of 3 to 12 feet in most places. A few rock outcrops occur.

Uneroded areas have relatively high natural fertility and a moderate organic-matter content. The reaction is medium to strongly acid. Tilth of the uneroded areas is good, but on the severely eroded parts it is very poor because the plastic silty clay plow layer puddles easily when too wet and breaks into hard clods when dry. Internal drainage is good, but the steep slope makes the soil very susceptible to erosion. The less eroded areas have fairly high water-holding capacity; the severely eroded parts are droughty.

Use suitability and management.—About half of this soil has been cleared and used for crops; the other half is under native forest. Little of the cleared land is cultivated now. Most of it is in permanent pasture or has reverted to forest. This soil is poorly suited to tilled crops because of its strong slope and susceptibility to erosion. Careful management is necessary to support and maintain grazing vegetation of good quality. See group 14 in the section on Use and Management for suggested management of this soil.

Dewey silt loam, hilly phase (12–25% slopes) (DN).—Strong slope and little erosion distinguish this phase. The 5- to 8-inch surface layer is brown or dark-brown friable silt loam. Below this lies lighter brown silt loam that grades to silty clay loam. The subsoil, from a depth of about 14 to 36 inches, is reddish-yellow to red firm but friable silty clay loam, grading with depth to silty clay. The underlying material is firm silty clay, red or yellowish red grading to lighter color with depth. Splotches of yellow increase with depth, and there are a few small chert fragments. Limestone bedrock generally is 6 to 14 feet from the surface.

Internal drainage is good, but the subsoil is firm enough to retard percolation, and runoff develops quickly. The fertility is moderately high, and the content of organic matter is greater than for most soils of the county. The reaction is medium to strongly acid. Tilth is good, and water-holding capacity is fairly high. The small areas of this soil occur in the Dewey-Dunmore soil association.

Use suitability and management.—Most of the hilly phase is in cutover deciduous forest. Its strong slope limits its suitability for crops, but under careful management it is good for most general farm crops if they are grown in a long rotation. Alfalfa, red clover, grasses, small grains, and an occasional row crop in the rotation are a productive combination. Crops requiring much cultivation and other field work are not well suited, for the erosion hazard is great and the soil is hard to work. Permanent grass-and-legume pasture gives good

yields, and much of the cleared acreage is used for this purpose. Management practices for this soil are discussed in group 10 in the section on Use and Management of Soils.

Dunmore silt loam, rolling phase (5–12% slopes) (Ds).—This soil, like others of its series, is characterized by a light yellowish-brown silt loam surface layer and a compact yellowish-red subsoil underlain by limestone, usually at depths of 3 to 10 feet. Compared with that of the Dewey soils, the surface layer of this soil is lighter colored and its subsoil is lighter red and somewhat more compact. The soil is widely distributed throughout the Dunmore-Greendale soil association. A great part of it occupies broad ridge tops, where it is associated with extensive areas of Dunmore hilly phases and eroded rolling phases. Some less sloping areas occur on the ridge crests.

Profile description:

0 to 10 inches, light yellowish-brown or very pale-brown friable silt loam.
10 to 24 inches, reddish-yellow, grading to yellowish-red, firm moderately compact silty clay that breaks easily to nut-sized aggregates.
24 to 28 inches, yellowish-red very firm silty clay splotched with yellow; upper part has few splotches but lower part is profusely splotched; dominant color below 40 inches is light reddish yellow; limestone bedrock is usually at depths of 3 to 10 feet.

The natural fertility and organic-matter content are not so high as for the Dewey soils. The reaction is medium to strongly acid. The moisture-holding capacity is moderate. Internal drainage, though retarded by the firm subsoil, is adequate for good plant growth. Tilth is good.

Use suitability and management.—Most of Dunmore silt loam, rolling phase, is occupied by cut-over deciduous forest, chiefly oaks with some pine. It is well suited to general farm crops—alfalfa, red clover, lespedeza, grasses, small grains, corn, and tobacco. It is not well suited to many truck crops, especially to such root crops as potatoes. It responds to good management and appears to be particularly well suited to livestock farming. Good quality grass-and-legume pastures are easily maintained where the soil has been fertilized. For a discussion of use and management, see group 6 in the section on Use and Management of Soils.

Dunmore silt loam, hilly phase (12–25% slopes) (Dr).—Stronger slope differentiates this soil from Dunmore silt loam, rolling phase. In general the surface layer is thinner and the depth to bedrock is less. The acreage is widely distributed throughout the Dunmore-Greendale soil association.

Use suitability and management.—All of Dunmore silt loam, hilly phase, is in cut-over deciduous forest. It is suited to most farm crops, especially alfalfa, red clover, small grains, and pastures of legumes and grasses. Its strong slope and slowly permeable subsoil require moderately long rotations. It is likely that permanent pasture will give good yields. Where the soil is required for crops, fall-sown small grains and hay and pasture crops should make up a great part of the rotation. Such row crops as corn and tobacco produce well, but great care is required to maintain the soil against erosion. For a discussion of use and management, see group 10 in the section on Use and Management of Soils.

Dunmore silt loam, steep phase (25–60% slopes) (Dt).—Stronger slope and a shallower depth to bedrock distinguish this phase from the rolling and hilly phases of Dunmore silt loam. Limestone bedrock is within a few feet of the surface. Outcrops of bedrock are common but do not prohibit tillage. In most places the pale-brown silt loam surface layer is thinner than for the smoother uneroded Dunmore phases. This is one of the less extensive Dunmore soils; it is widely distributed throughout the Dunmore-Greendale soil association. Most areas are closely associated with the hilly phases of the Dunmore soils.

Use suitability and management.—Practically all of the steep phase is in cut-over deciduous forest with some pine (pl. 2, *A*). Chiefly because of its strong slope, it is not suited to crops. Cleared areas are suitable for pasture and are capable of producing high quality legumes and grasses where the natural fertility is maintained or improved. Even under grass vegetation the soil is susceptible to erosion if care is not taken to avoid overgrazing. See group 14 in the section on Use and Management of Soils for suitable management of this soil.

Dunmore silty clay loam, eroded rolling phase (5–12% slopes) (Dr).—Cultivated areas of Dunmore silt loam, rolling, that have been eroded comprise this phase. In most places the subsoil has been mixed with the original surface soil to form a plow soil of yellowish-brown moderately friable silty clay loam. Below this plow soil lies silty clay subsoil material similar to that of the subsoil for the rolling phase. Limestone bedrock is usually at 2½ to 9 feet. Areas are widely distributed throughout the Dunmore-Greendale and Dewey-Dunmore soil associations. The tracts are large, and with the other Dunmore rolling phases dominate the landscape in places.

Natural fertility approximates that of uneroded Dunmore soil but tilth is less favorable. The reaction is medium to strongly acid. The heavy subsoil retards percolation, and runoff develops quickly during rains. Internal drainage, however, is adequate for the crops commonly grown.

Use suitability and management.—All of this soil has been cleared and cultivated, and much is now used for general farm crops and pasture. Corn and tobacco are the chief row crops, and lespedeza, alfalfa, and red clover the principal hay crops. Small grains occupy a fair acreage.

This soil is suited to most general farm crops of the county and responds well to good management. Where such management is practiced, a 3- to 4-year rotation consisting of corn or tobacco, a small grain, and legume-and-grass hay is well suited. The eroded condition makes the soil somewhat more subject to runoff than the uneroded phase, but it can be kept productive if it is used for close-growing legumes and grasses much of the time. Legume-and-grass pastures produce well and are easily maintained if the soil is fertilized. For a discussion of use and management, see group 6 in the section on Use and Management of Soils.

Dunmore silty clay loam, eroded hilly phase (12–25% slopes) (Dx).—Areas of the hilly phase that have been eroded considerably are represented by this phase. The plow layer consists of subsoil material mixed with the original surface material. In most places it

is yellowish-brown silty clay loam. The underlying subsoil is yellowish-red very firm silty clay that grades with depth to lighter red splotched with yellow. Limestone bedrock is at 1½ to 7 feet. There may be a few rock outcrops. Small spots that have lost the entire surface layer through erosion are common (pl. 2, *B*). In these spots the plow layer consists of yellowish-red very firm silty clay. Percolation is retarded by the compact subsoil, but internal drainage is adequate for all crops. Areas are widely distributed throughout the Dunmore-Greendale soil association.

Natural fertility is moderate, organic-matter content low, and the reaction medium to strongly acid. The moisture-holding capacity is moderate except in the more severely eroded areas, where it is very low.

Use suitability and management.—Practically all of this soil has been cleared for many years. About 20 percent is now idle, 20 percent is in pasture, and the rest is in crops, chiefly hay but also small grains, corn, and tobacco. Rotations are of moderate length, and moderate fertilization is common.

This soil is suited to crops if a high level of management is practiced. As particular care is required to prevent erosion, long rotations consisting chiefly of small grains and legume-and-grass mixtures for hay and pasture are best suited. Such row crops as corn and tobacco are suited but can be grown only at long intervals in rotation with close-growing crops. Truck crops are not desirable, owing to the difficult workability and conservability of the soil and the unfavorable compact nature of the subsoil. Management for this soil is discussed in group 10 in the section on Use and Management of Soils.

Dunmore silty clay loam, eroded steep phase (25–60% slopes) (Dz).—This phase represents areas that have lost a notable part of the surface soil through erosion. The plow layer, a yellowish-brown silty clay loam, is underlain at depths of 5 to 6 inches by yellowish-red very firm or moderately compact silty clay. The silty clay grades to lighter red very firm silty clay with mottlings of yellow. Limestone bedrock is usually at 1 to 6 feet. There are some rock outcrops but not enough to prevent tillage. Throughout most areas there are small patches where all the surface layer and, in places, part of the subsoil have been removed by erosion. In these areas the plow layer consists of yellowish-red or reddish-yellow very firm silty clay. This soil is widely distributed throughout the Dunmore-Greendale soil association, mostly in small areas.

Use suitability and management.—All of this soil has been cleared and probably cropped at one time. Much of it is now in unimproved pasture or lies idle; little is cropped. Strong slope and compact subsoil make this phase poorly suited to crops and subject to erosion. Good stands of high quality pasture plants can be maintained with good management including adequate fertilization. Pasture is probably its best use under most circumstances. On the steeper areas where erosion is most difficult to control it may be best to establish forest. For further discussion see group 14 in the section on Use and Management of Soils.

Dunmore silty clay, severely eroded rolling phase (5–12% slopes) (Dv).—Areas of Dunmore silt loam, rolling, that have lost by erosion practically all of the original surface soil and part of the subsoil make up this phase. The plow layer consists of 4 or 5 inches

of firm or fairly compact yellowish-red silty clay. Below this is yellowish-red very firm silty clay that grades to light reddish-yellow splotched with yellow. Limestone bedrock is at 2 to 8 feet. Most tracts lie on slopes below smoother areas of Dunmore soils on the broad ridge tops. They are widely distributed throughout the Dunmore-Greendale soil association.

The very poor tilth, low water-holding capacity, strongly acid reaction, and very low organic-matter content result in low productivity and poor workability.

Use suitability and management.—All of this soil has been cleared and used for crops, but much of it now is either idle or in unimproved pasture. Some small grain, hay, and corn are raised, but yields are low. The heavy plow layer limits suitability for agricultural use, and truck crops are not suited. Under most conditions the soil is probably best for legume-and-grass hay and pasture, but small grains can be an important part of a long rotation. Increasing the organic-matter content, especially to improve tilth and moisture-holding capacity, is among the chief requirements for improving the soil for crops. For a discussion of use and management, see group 9 in the section on Use and Management of Soils.

Dunmore silty clay, severely eroded hilly phase (12–25% slopes) (Du).—This phase represents areas of Dunmore silt loam, hilly phase, from which erosion has removed most of the surface soil and, in places, part of the subsoil. The plow layer consists of yellowish-red very firm or compact silty clay; the underlying subsoil is yellowish-red very compact silty clay, grading to lighter very firm silty clay with splotches of yellow. Limestone bedrock is generally at 1 to 6 feet. Rock outcrops are fairly common but do not prohibit tillage. Small gullies are especially common in areas that have not been tilled for the last 3 or 4 years. The acreage is widely distributed throughout the Dunmore-Greendale soil association on strong ridge slopes and around sinks. Much of this phase is closely associated with other hilly phases of the Dunmore soils.

Use suitability and management.—Because of the strong slopes and compact or heavy plow layer, this soil is very poorly suited to crops. Under management that includes fertilization and liming it is capable of supporting good quality pasture, but plant growth is restricted during dry periods by lack of moisture. During the moister parts of the growing season, legumes and grasses grow well where adequately fertilized. See group 15 in the section on Use and Management of Soils for suitable management of this phase.

Dunmore silty clay, severely eroded steep phase (25–60% slopes) (Dw).—In this phase are former areas of Dunmore silt loam, steep phase, from which erosion has removed practically all of the surface soil and, in places, part of the subsoil. The plow layer consists of yellowish-red or reddish-yellow very firm or moderately compact silty clay. The underlying material is reddish-yellow very firm silty clay with splotches of yellow. Limestone bedrock is generally at 1½ to 5 feet, and outcrops are not abundant enough to prohibit tillage. The small areas are widely distributed throughout the Dunmore-Greendale soil association.

Tilth is very poor because the plow layer is heavy-textured. The organic-matter content is low, and the reaction is strongly acid. The

moisture-holding capacity is very limited, so the soil is relatively droughty. Runoff develops quickly during rains and rapidly removes soil material from cultivated areas.

Use suitability and management.—All of this soil has been cleared, and a great part has been cropped at some time. Because of its steep slope and compact plow layer, the soil is very poorly suited to crops. In most places it is best used for forest. Under very careful management, including adequate fertilization and controlled grazing, it is capable of producing fair legume-and-grass pasture. For a discussion of use and management, see group 19 in the section on Use and Management of Soils.

Emory silt loam (0–5% slopes) (EA).—This brown well-drained soil consists of alluvium washed chiefly from Dunmore and Dewey soils. It occupies fairly narrow strips along drainways and small areas in sinks. The areas along the drainways have a very gentle slope and, except under very heavy precipitation, are not subject to overflow. The areas in the sinks are nearly level or saucerlike, and much of their acreage is subject to temporary ponding because most of the water that flows onto them from surrounding slopes is carried away only through subterranean outlets.

Although this soil is considered well drained, excess soil moisture is removed somewhat more slowly than from many of the higher lying soils such as the Dewey, Allen, and Jefferson. This is one of the less extensive soils in the county, and practically all of it is in the Dewey-Dunmore and Dunmore-Greendale soil associations.

Profile descriptions:

On the more sloping higher lying part:

0 to 15 inches, brown to yellowish-red silt loam.
15 to 30 inches, red friable silty clay loam.
30 to 48 inches, yellowish-red firm but friable silty clay loam.

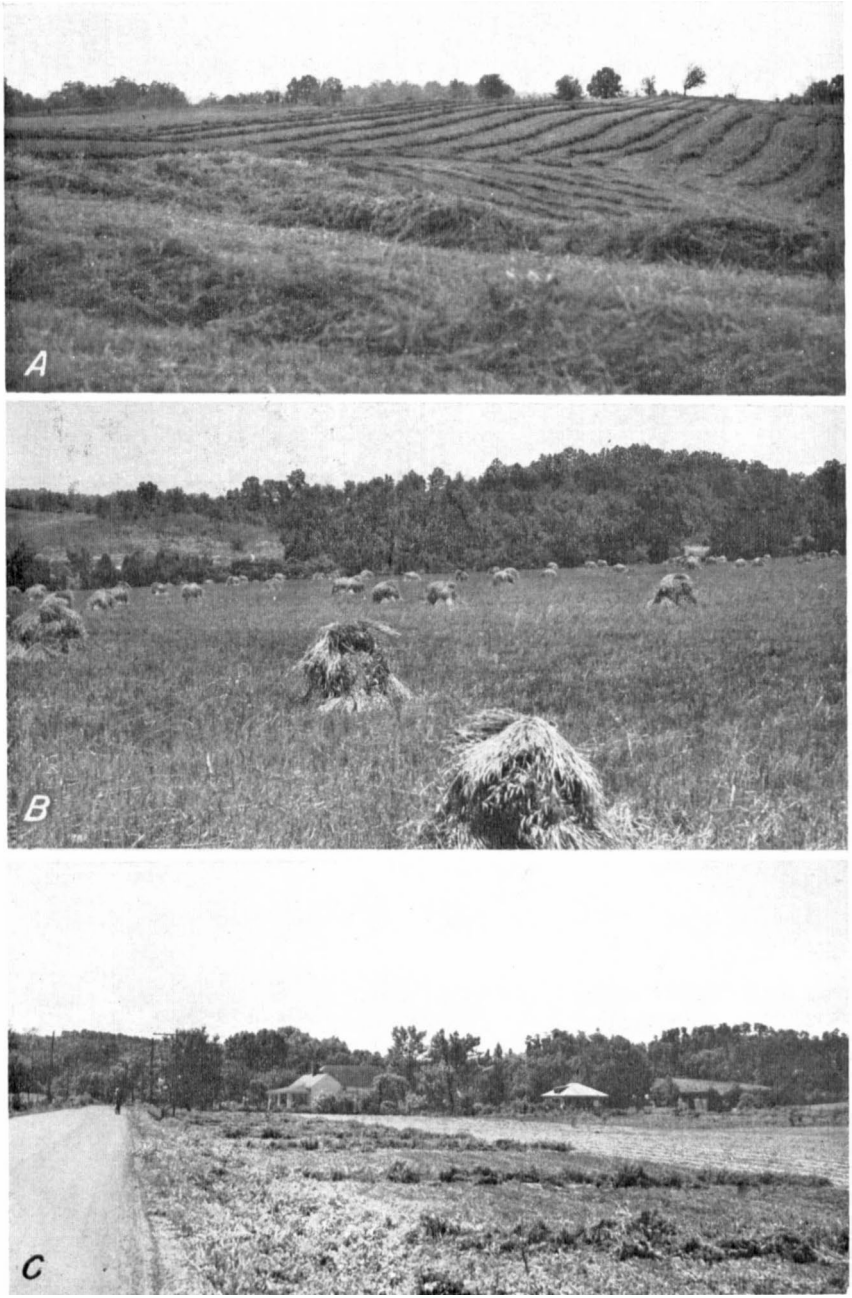
In the nearly level parts in the sinks and drainways:

0 to 24 inches, brown to dark-brown silt loam, with a darker layer at depths of 10 to 18 inches in many places that is an old surface layer buried by more recent overwash.
24 to 40 inches, somewhat lighter brown friable silt loam with a variable quantity of mottling below 26 inches; limestone bedrock is generally at 3 to 10 feet.

This is one of the most fertile soils in the county. It has a moderately high organic-matter content and is about medium acid in reaction. Tilth is good. The soil is relatively permeable, especially the lower lying areas. Some of the higher lying areas have a moderately firm subsoil. Moisture-holding capacity is good, and the low position in the landscape favors the maintenance of soil moisture. Very little of the acreage is subject to erosion.

Use suitability and management.—This soil, one of the most productive of the county, is suited to intensive use and is valued highly for tilled crops. Practically all of it is cleared and cultivated, and a great part is used for corn, tobacco, and other row crops. Some truck crops and vegetables are grown. Some areas are used for small grains and hay, but little is in permanent pasture.

Where the fertility is maintained, it is feasible to use very short rotations and row crops can be grown several years in succession. The soil is well suited to a wide variety of crops, including alfalfa and

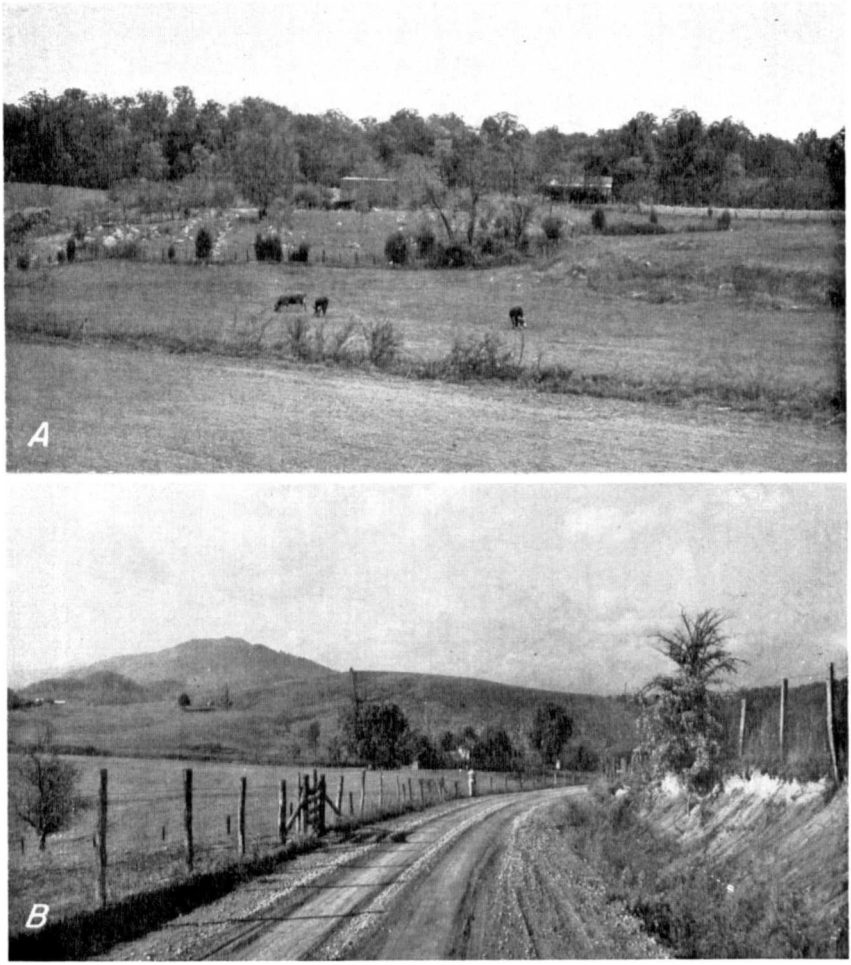


A, Lespedeza hay on Dewey silty clay loam, eroded rolling phase.
B, Winter wheat on Holston cobbly loam, undulating phase; hilly Dandridge soils in background.
C, Productive crop of alfalfa on State loam.
All photos by courtesy of Tennessee Valley Authority.

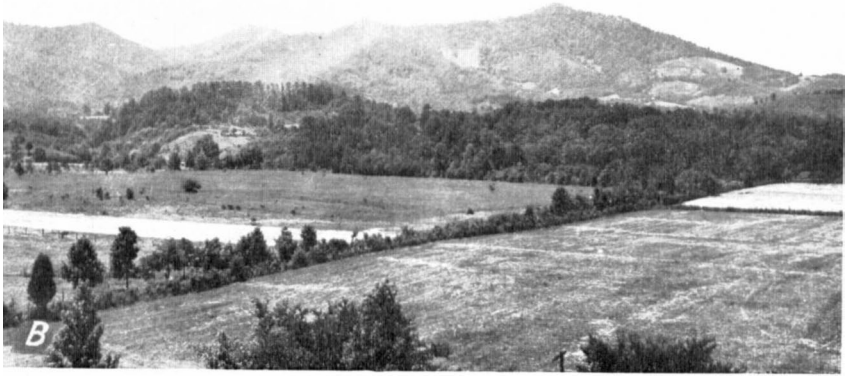
A, Pasture and forest on Dunmore silt loam, steep phase. The forest is chiefly oaks with shortleaf and scrub pines intermixed.

B, An area of Dunmore silty clay loam, eroded hilly phase. Lightest colored parts still have much of their original grayish or very pale brown friable surface soil; darker parts have lost all of their original surface soil, leaving the more compact heavy red subsoil exposed.

All photos by courtesy of Tennessee Valley Authority.



A, Pasture on Greendale silt loam and Stony hilly land (Dunmore soil material). *B*, Road cut through Groseclose silt loam, rolling phase, exposing light-gray surface soil and yellow subsoil; shalelike material occurs at 2 feet here. Smooth productive soils chiefly of the Greendale and Lindside series in the broader parts of the valley in the Dunmore-Greendale soil association; hilly Dewey and Dunmore soils on hill in near background; and chiefly Ramsey soils and Rough mountainous land (Ramsey soil material) on distant mountain.
All photos by courtesy of Tennessee Valley Authority.



A, Limestone outcrops on Stony hilly land (Dunmore soil material).
B, Predominantly smooth Holston soils of the Holston-Monongahela-Tyler soil association in foreground; Dandridge-Leadvale-Hamblen soil association on partly forested hilly middle area; and Ramsey (sandy)-Stony land soil association on English Mountain in far background.
All photos by courtesy of Tennessee Valley Authority.

tobacco. Small grains, however, are subject to lodging on the lower lying areas because of the exceptionally favorable moisture conditions and high fertility. The common grasses and legumes for pasture grow luxuriantly and afford good quality grazing with a high carrying capacity. Erosion control measures are required only on the most sloping areas. See group 3 in the section on Use and Management of Soils for further information on management.

Greendale silt loam (1–9% slopes) (GA).—This light-brown well-drained soil consists of alluvium derived chiefly from Dunmore and Groseclose soils. It occupies narrow strips along drainways and gentle foot slopes, and a small acreage is in sinks. The separate areas are small; most of them are associated with rolling and hilly Dunmore soils of the Dunmore-Greendale and Groseclose-Greendale soil associations.

Profile description:

0 to 10 inches, light-brown or light yellowish-brown silt loam.
10 to 30 inches, light yellowish-brown to yellowish-brown firm but friable silty clay loam.
30 inches +, light yellowish-brown or very pale-brown firm but friable silty clay loam somewhat mottled with yellow, gray, and brown; limestone bedrock is generally at 3 to 10 feet.

In some places, especially those adjacent to the drainage channel, the mellow silt loam surface layer may be thicker. A small quantity of chert occurs throughout much of this soil, and in places it interferes with cultivation.

This moderately fertile soil has a fairly low organic-matter content. It has good tilth, however, and very favorable moisture relations. It has a high moisture-holding capacity, and most of the areas benefit from runoff and seepage from the adjacent higher lying soils. Erosion is a hazard only on the most sloping parts.

Use suitability and management.—A great part of Greendale silt loam is cleared and cropped, and much is used for row crops. Corn, tobacco, hay, and small grains are commonly grown, and yields are moderately high.

This soil is well suited to intensive use, although it requires heavier fertilization than the Emory soil to attain high fertility. It is suited to practically all the commonly grown crops, including tobacco, many truck crops, and alfalfa. It appears better suited to small grains than the Emory soil, as the hazard of lodging is somewhat less. It is especially desirable for midsummer and fall grazing (pl. 3, *A*), because of its favorable moisture supply. For a discussion of use and management, see group 3 in the section on Use and Management of Soils.

Groseclose silt loam, rolling phase (5–12% slopes) (Gc).—Development of this light-colored moderately well-drained soil has taken place over shaly limestone or limestone with interbedded shale (pl. 3, *B*). Compared with the Dunmore soils, this phase has a subsoil more compact and heavy, and shaly limestone bedrock at a shallower depth. The higher parts on the ridge crests may have a less sloping surface, but their acreage is relatively small. This soil is not very extensive and nearly all of it is in the Groseclose-Greendale soil association in the eastern part of the county adjacent to the Greene County line.

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Profile description:

0 to 10 inches, very pale-brown or light-gray mellow silt loam.
10 to 18 inches, yellow moderately compact silty clay that breaks to blocky fragments of medium size.
18 to 36 inches, strong-brown, mottled with yellow and gray, compact silty clay containing some shale fragments; shaly limestone or shale bedrock at 2½ to 8 feet.

An occasional rock outcrop occurs. The surface layer in some areas is 14 to 24 inches thick and consists of very pale-brown silt loam with a moderate content of fine chert fragments.

Natural fertility and organic-matter content are low. The reaction is strongly acid. The surface soil has good tilth and is permeable to moisture, but the clay subsoil is compact, slowly permeable, and intractable in most places. The moisture-holding capacity is fair in most places and somewhat better where the yellow clay material is at a greater depth. Because of sloping surface and heavy subsoil, much of the acreage is subject to erosion.

Use suitability and management.—All of this soil is in cut-over deciduous forest. Though not one of the most productive soils, it is suited to most crops commonly grown. It requires moderately long rotations consisting chiefly of hay and small-grain crops. It is suited to pasture, but requires substantial amounts of lime and fertilizer for production of the more desirable legumes and grasses. See group 7 in the section on Use and Management of Soils for suitable management.

Groseclose silt loam, hilly phase (12–25% slopes) (GB).—A stronger slope, a little thinner surface layer in most places, and a smaller average depth to bedrock are the chief differences between this soil and the rolling phase. There may be an occasional rock outcrop. All areas are in the Groseclose-Greendale soil association, most of them along the southeastern edge.

The 6- or 8-inch surface layer is very pale-brown silt loam. It is underlain by yellow very firm or compact silty clay. Fertility and organic-matter content are low, and the reaction is strongly acid. Tilth of the plow layer is favorable, and moisture-holding capacity is moderate. Moisture conditions are probably more favorable for crops on the north-facing slopes, especially during the drier parts of the growing season.

Use suitability and management.—Practically all of the hilly phase is in cut-over deciduous forest with some pine intermixed. It has limited suitability for hay and pasture crops and small grains. Row crops, especially corn, are suitable if grown in very long rotations with close-growing crops. Truck crops and tobacco are not well suited, but alfalfa can be grown where high fertility is maintained. On many farms that have sufficient acreage of more productive soils, this hilly Groseclose soil should be used for permanent pasture after its fertility has been brought to a fairly high level. For a discussion of use and management, see group 11 in the section on Use and Management of Soils.

Groseclose silty clay loam, eroded rolling phase (5–12% slopes) (GE).—This phase differs from the rolling phase of Groseclose silt loam chiefly in having lost a considerable part of its surface soil. The plow layer is yellow or grayish-yellow friable silty clay loam. In most places the yellow silty clay subsoil is directly below it. In a

few areas a yellowish-gray friable silt loam containing some fine chert fragments is under the surface layer and the yellow silty clay is 12 or 14 inches below the surface. Some included areas have lost all the surface soil and, in places, part of the subsoil through erosion. Their plow layer consists of yellow compact silty clay. These more severely eroded areas are represented on the soil map by appropriate symbol. This eroded rolling phase is in the Groseclose-Greendale soil association.

Natural fertility is moderately low, organic-matter content is low, and reaction is strongly acid. A few outcrops of bedrock appear in places. The tilth of the plow layer is fairly good, except in the severely eroded spots, where it consists predominantly of subsoil material. The water-holding capacity is fairly high in the less eroded areas, but very low in the severely eroded spots. Internal drainage is moderately good, but percolation of moisture is greatly retarded by the clay subsoil.

Use suitability and management.—All of this soil has been cleared and cropped, and much is now used for lespedeza and small grains, especially wheat. A small part is idle, and some is pastured. Fertilization is practiced to a limited extent.

Though not very productive, this soil responds to good management and is suited to most general farm crops when well handled. Erosion is active, so long rotations consisting mostly of close-growing crops are advisable for most areas. Areas where the yellow clay subsoil is at depths of 16 inches or more are suited to somewhat more intensive use. For further discussion, see group 7 of the section on Use and Management of Soils.

Groseclose silty clay loam, eroded hilly phase (12–25% slopes) (GD).—Areas of Groseclose silt loam, hilly phase, that have been cleared and subjected to considerable erosion make up this phase. Most of the acreage has lost one-half to three-fourths of the original surface soil, and consequently the plow layer consists of grayish-yellow silty clay loam. Below the plow layer is the yellow very compact silty clay subsoil. Shaly limestone bedrock or limestone with shale interbedded lies at 1 to 5 feet in most places. In places practically all the original surface soil and part of the subsoil have been eroded away and the plow layer consists of yellow very firm silty clay. These more severely eroded areas are represented on the soil map by appropriate symbol. Some areas have gradients up to 45 percent. This soil, the most extensive of the Groseclose series, is mapped in the Groseclose-Greendale soil association.

Natural fertility and organic-matter content are low, and reaction is strongly acid. A few rock outcrops and some chert or shale fragments occur on the surface in places. The water-holding capacity is not great—the clay subsoil retards percolation of moisture. Runoff develops quickly during rains and rapidly removes soil material from cultivated areas.

Use suitability and management.—All of this phase has been cleared and cropped for several years. A great part is now in permanent pasture; a small acreage is idle or reverting to forest. The areas cropped at present are chiefly in hay and small grains, though a smaller acreage is in corn and other row crops. The less steep areas are considered suitable for cultivation, but long rotations that include

small grains and grass-and-legume mixtures for hay and pasture are required. Truck crops and tobacco are not well suited, because moisture relations limit productivity, steep slopes make cultivation difficult, and erosion losses are great. For further discussion, refer to group 11 in the section on Use and Management of Soils.

Gullied land (Dandridge soil material) (12–50% slopes) (GF).—This land type consists of areas of Dandridge soils or mixed Dandridge and Litz soils that have been greatly damaged by erosion. Practically all the surface soil and much of the subsoil have been lost, and gullies form an intricate pattern too rough for the operation of farm machinery. The material exposed has poor tilth, unfavorable moisture relations, and low fertility. Calcareous or leached calcareous shale is exposed in many places. Most areas are small; they are widely distributed throughout the Dandridge-Leadvale-Hamblen and Steep Dandridge-Whitesburg-Hamblen soil associations.

Use suitability and management.—All of this land has been cleared and cultivated at one time. Severe erosion has made the land unsuitable for either crops or pasture and practically all of it is now abandoned and growing up to brush and weeds. Some of the less rough areas probably could be improved to the point where they would support legume-and-grass pasture, but the limited water-holding capacity discourages even this use. Forest is generally the best use. For a discussion of use and management, see group 19 in the section on Use and Management of Soils.

Gullied land (Dunmore soil material) (12–45% slopes) (GG).—Areas of Dunmore and similar associated soils over limestone that have been very severely eroded constitute this land type. Practically all of the original surface soil and much of the subsoil have been lost through erosion, and gullies form an intricate pattern. Many gullies cannot be crossed with machinery, and in a few places they have cut down to bedrock. The surface material is predominantly a silty clay of very poor tilth, low organic-matter content, and very low moisture-holding capacity. The small areas are widely distributed throughout the Dunmore-Greendale association in close association with hilly Dunmore soils.

Use suitability and management.—All of this land was cleared and cropped at one time, but practically all of it is now idle or abandoned. Most areas have a sparse to moderately sparse mixed growth of broomsedge, sassafras, briers, persimmon, and other plants.

This land type is not suitable for either crops or pasture in its present state. Some of the less rugged areas could be smoothed with heavy machinery to allow seeding to pasture grasses and legumes, but unfavorable tilth, low water-holding capacity, great susceptibility to erosion, and low fertility makes it doubtful that the pasture produced would cover the cost of reclamation. Probably the best use for this land is forest. Possibly some areas, after producing a crop of timber, will be in suitable physical condition to make reseeding of pasture a practical enterprise. For further discussion, refer to group 19 in the section on Use and Management of Soils.

Hamblen silt loam (0–2% slopes) (HB).—The parent material of this light-brown imperfectly drained soil on bottom lands came chiefly from calcareous shale. The soil is distinguished by its mottled subsoil

and generally slightly acid reaction, though some areas are medium acid. Its surface is nearly level, and it is subject to overflow. Much of it occurs as moderately wide strips along the larger creeks in the Dandridge-Leadvale-Hamblen and Steep Dandridge-Whitesburg-Hamblen soil associations. A smaller part is mapped in narrow strips along the creeks in the Ramsey (silt loam)-Hamblen soil association.

Profile description:

0 to 16 inches, pale-yellow or light-brown mellow silt loam; color varies to brown or yellowish brown, and there may be a few mottlings in the lower part.

16 to 36 inches, friable silty clay loam mottled with pale-yellow, brown, and some gray; gray may be predominant below 28 or 30 inches; shale bedrock is at 3 to 10 feet.

A brown or dark-brown silt loam layer occurring at depths of 6 to 14 inches in some places represents an old surface layer on which lighter colored material has been deposited.

This moderately fertile soil has a great water-holding capacity. Tilth is good, but excess moisture during wetter periods somewhat interferes with field work. This frequently delays the planting of crops and occasionally interferes with cultivation and harvesting. Erosion is not a hazard, but overflow occasionally damages crops.

Use suitability and management.—Most of Hamblen silt loam is cleared and used for corn or hay crops of lespedeza and red clover. Little small grain is grown. Imperfect drainage and susceptibility to overflow make truck crops, tobacco, potatoes, and alfalfa poorly suited. The high fertility, abundant moisture supply, and ease of tillage with little or no hazard from erosion encourage intensive use for such row crops as corn, sorghums, and possibly soybeans. This soil also gives good yields of lespedeza, red clover, and timothy hay. It is productive of the more desirable pasture legumes and grasses and, because of its favorable moisture conditions, provides supplementary pasture during the more droughty part of the grazing season when upland pastures are dry. See group 1 in the section on Use and Management of Soils for appropriate management of this soil.

Hamblen fine sandy loam (0–2% slopes) (HA).—Lighter texture, greater permeability, and lower fertility distinguish this soil from Hamblen silt loam. It is a light-brown imperfectly drained soil on bottom lands along the creeks in areas dominated by Ramsey stony fine sandy loam soils. The surface is nearly level, and the areas are subject to overflow. Practically all of the acreage is in the Ramsey (silt loam)-Hamblen and the Ramsey (sandy)-Stony land soil associations.

Profile description:

0 to 6 inches, grayish-brown or pale-brown fine sandy loam.

6 to 18 inches, light grayish-brown or very pale-brown friable fine sandy loam.

18 to 32 inches +, mottled gray, yellow, and brown somewhat firm but friable fine sandy clay loam becoming grayer with depth; shale or sandy bedrock at depths of 3 to 10 feet.

In places there may be a darker brown layer at depths of 6 to 15 inches. In some areas Hamblen fine sandy loam is underlain at 28 to 36 inches by beds of shale or by gravel made up of pieces of sandy rock.

This is a moderately fertile soil with a fair content of organic matter. It is medium acid to neutral, permeable, and fair in capacity

for holding moisture available to crops. The water table is within a few feet of the surface a great part of the time. Some stones or cobbles occur in places but do not seriously interfere with tillage.

Use suitability and management.—Most of Hamblen fine sandy loam has been cleared and is now chiefly in corn and lespedeza and red clover hay. Parts are used for pasture. Because of the smooth surface, good supply of moisture, and good tilth, this soil is well suited to and may be used intensively for corn, sorghum, soybeans, and such hay crops as lespedeza, red clover, orchard grass, and timothy. Areas may be suitable for tobacco, but the soil is generally not highly productive of tobacco, alfalfa, potatoes or other truck crops. It responds well to good management. Field operations are frequently delayed in spring because of wetness, but the sandy texture helps get rid of excess moisture following rainy periods or floods. Occasional floods interfere with field operations and damage crops during the growing season. For a discussion of use and management, see group 1 in the section on Use and Management of Soils.

Hayter silt loam, eroded rolling phase (3–10% slopes) (Hc).—This yellowish-brown friable well-drained soil occupies the higher foot slopes of colluvium in the Ramsey (silt loam)-Hamblen soil association. Most areas occur as small narrow strips directly below strong slopes of Ramsey shaly silt loam soils. The soil is associated with soils on alluvium (Barbourville, Staser, and Hamblen) that lie along the drains below it.

Profile description:

0 to 10 inches, yellowish-brown to light yellowish-brown friable silt loam with a silty clay loam texture in places.

10 to 24 inches, yellowish-brown moderately firm but friable silty clay loam that breaks to medium blocky fragments.

24 inches +, light yellowish-brown or very pale-brown firm, somewhat compact, silty clay loam or silty clay with some gray, yellow, and brown mottlings; slate or shale bedrock is usually at depths of 2 to 8 feet.

This fertile soil is fair in content of organic matter, medium acid, permeable, and good in tilth characteristics. Moisture-holding capacity is moderately high, and the soil is not droughty. Some slate or shale fragments occur in places, but do not interfere with cultivation.

Use suitability and management.—Most areas are cleared and used intensively for crops, for all the soil occurs in landscapes where the acreage of soils suitable for cultivation is very limited. Corn and tobacco, the chief crops, produce moderately high yields. Most truck crops, small grains, and practically all legumes and grasses yield well. The more sloping areas are subject to erosion and are best suited to moderately long rotations. See group 6 in the section on Use and Management of Soils for further information on management of this soil.

Holston loam, undulating phase (1–5% slopes) (Ho).—This soil, like others of the Holston series, has a yellowish subsoil and occupies old stream benches consisting of material derived from shale, slate, and sandy rock. Intermixed with this in most places is some material from limestone and micaceous rocks. Most areas are on moderately high stream terraces in the Holston-Monongahela-Tyler soil association along the French Broad, Nolichucky, and Pigeon Rivers and Cosby Creek. Some areas occupy high stream terraces in the Holston-Nolichucky-Dandridge soil association north of Bybee.

Profile description:

0 to 12 inches, pale-yellow loam.
12 to 30 inches, brownish-yellow firm but friable clay loam.
30 to 48 inches, yellow moderately compact clay loam mottled with gray and brown; bedrock—shale in most places—is usually at depths of 3 to 15 feet.

In some places a 1- to 3-foot gravelly bed occurs below 3½ feet. The subsoil below 2½ feet has a weak reddish cast in places. Patches with some cobblestones on the surface also occur. A few areas are on low stream terraces and have a light-brown or brown surface layer. In some of these areas the subsoil is compact, and in most there are some mica flakes.

This soil is low in fertility and organic matter and medium to strongly acid. It is permeable and has good tilth and moderate internal drainage, although percolation is somewhat retarded. Its moisture-holding capacity is moderately high, and it responds to good management. It is easy to work and conserve.

Use suitability and management.—A very small acreage is in mixed deciduous and pine forest, and some is pastured, but the greatest part is used for crops—chiefly corn, wheat, and lespedeza hay. The soil is suited to and used for a wide variety of crops, including many truck crops, potatoes, tobacco, and small grains. Alfalfa is more difficult to maintain than on the more fertile well-drained soils. Yields are not high under common management. Much of the acreage has been limed, and fertilizer is usually applied to the cash crops, corn, and wheat. With substantial fertilization this soil is suited to intensive use, but the improvement and maintenance of fertility requires constant care. Good tilth is not difficult to maintain, and runoff water is not especially difficult to control. Pastures of good quality can be established but require substantial liming and fertilization. Management practices for this soil are discussed in group 5 in the section on Use and Management of Soils.

Holston loam, eroded rolling phase (5–12% slopes) (HN).—This phase differs from the undulating phase of Holston loam chiefly in being eroded and in having stronger slopes. Much of it has been eroded to such extent that the plow layer is a mixture of surface soil and subsoil. In these eroded places the surface 5 inches is brownish-yellow loam. In some areas the plow layer is predominantly subsoil material of clay loam texture. The total thickness of the soil is less than that of the undulating phase, and bedrock is usually 2½ to 12 feet below the surface. Areas are associated with the undulating phase on moderate to high stream terraces, chiefly along the French Broad, Nolichucky, and Pigeon Rivers.

The soil is low in fertility and organic matter and is medium to strongly acid. Tilth and permeability are somewhat less favorable than for the undulating phase of Holston loam. The slope is strong enough to make runoff a problem.

Use suitability and management.—A very great part is cleared for crops and pasture. Corn, wheat, and lespedeza are the chief crops. Some tobacco is grown. Lime has been applied to much of the soil, and some fertilizer for corn and small grains. Erosion is active during heavy rains where row crops are grown or where the soil is without adequate vegetative cover. The moderately strong slope and low fertility require more exacting management to main-

tain productivity than is necessary on some of the smoother, more fertile soils. For a discussion of use and management, see group 7 in the section on Use and Management of Soils.

Holston loam, eroded hilly phase (12–25% slopes) (HM).—The parent material of this yellowish hilly well-drained soil consists chiefly of old alluvium that originated mainly from shale, slate, and sandy rocks. Intermixed in most places is some material from limestone, micaceous rocks, or both. Most of the acreage occurs in narrow strips along the edges of the moderately high to high stream terraces in the Holston-Monongahela-Tyler and Holston-Nolichucky-Dandridge soil associations.

Profile description:

0 to 5 inches, pale-yellow to brownish-yellow loam.
5 to 16 inches, brownish-yellow firm but friable clay loam.
16 to 28 inches +, yellow mottled with gray and brown moderately compact clay loam; bedrock—shale in most places—is usually at depths of 1½ to 10 feet.

A small acreage, still under native deciduous and pine forest, has a 6- or 8-inch pale-yellow loam surface soil. The thickness of soil varies greatly; the deepest areas are generally along the upper edge of the slopes. In places the underlying shale outcrops, usually part way down the slope.

This soil is low in fertility and organic matter and is medium to strongly acid. Tilth ranges from good to poor, depending on the quantity of subsoil material included in the plow layer. Permeability is moderate, and surface runoff is rapid. The tilled soil is notably subject to erosion. Water-holding capacity is only fair, and the south-facing slopes are generally more droughty than those facing north.

Use suitability and management.—The cleared land (about 90 percent of the total acreage) is mostly in pasture. The chief crops—corn, small grains, and lespedeza hay—produce low yields. Some fertilizer is used. Strong slopes and low fertility limit suitability; crops requiring frequent cultivation are not suited. Grass-and-legume mixtures for hay and pasture and small grains are among the better suited crops. A high state of productivity requires substantial fertilization, including lime and organic matter. Even in long rotations, cultivated areas require special attention for control of runoff. Group 11 in the section on Use and Management of Soils discusses this eroded hilly phase.

Holston clay loam, severely eroded rolling phase (5–12% slopes) (HE).—This phase represents areas of Holston loam that have been eroded to such extent that the plow layer now consists of subsoil material. The upper 20 or 25 inches is brownish-yellow firm clay loam; below this is yellow firm clay loam mottled with gray and brown. Bedrock—shale in most places—is usually at depths of 1½ to 10 feet. Small gullies are common. The areas are small and are associated with areas of other Holston soils.

This soil is low in fertility and organic matter and is medium to strongly acid. It has poor tilth, as it puddles easily when wet and is hard when dry. Moisture infiltrates slowly, and the capacity for holding moisture available to plants is small.

Use suitability and management.—All of this soil has been cleared and cultivated, but most of it now is reforested with pine, idle, or in

unimproved permanent pasture. Low fertility, unfavorable tilth, droughtiness, and susceptibility to erosion greatly limit the productivity and range of suitability for crops. Substantial fertilization, including use of lime and organic matter, following long crop rotations, and providing adequate protection from erosion are important parts of proper management. Small grains and grass-and-legume mixtures for hay and pasture are among the most suitable crops. Many areas probably can be used best for forest. For further discussion, see group 9 in the section on Use and Management of Soils.

Holston clay loam, severely eroded hilly phase (12–25% slopes) (HD).—This phase consists of areas of hilly Holston loam from which erosion has removed practically all of the surface soil and, in places, part of the subsoil. The plow layer is brownish-yellow firm but somewhat friable clay loam. Most of the gullies can be filled in without difficulty. The depth to bedrock, shale in most places, ranges from 1 to 8 feet. In places, however, the shale outcrops. Most of this phase occurs as small narrow strips on the escarpment slopes of stream terraces in association with other Holston soils.

This soil is low in fertility and organic matter and is medium to strongly acid. Tilth is unfavorable, and moisture infiltrates slowly. The water-holding capacity is low. The soil is usually droughty during drier parts of the growing season.

Use suitability and management.—Although all of this soil has been cleared and cropped at one time, most of it is now idle, in unimproved permanent pasture, or in reestablished pine forest. Unfavorable tilth, great susceptibility to erosion, and low fertility and water-holding capacity make it poorly suited to cultivation. It can produce good pasture with adequate lime and fertilizer and proper seeding. Many areas are best used for forest. For further discussion, see group 15 in the section on Use and Management of Soils.

Holston cobbly loam, undulating phase (2–5% slopes) (HL).—Sufficient gravel and cobblestones to interfere with cultivation is the chief differences between this soil and Holston loam, undulating phase. The surface 10 or 12 inches is pale-yellow cobbly loam. Below this is brownish-yellow firm but friable cobbly clay loam. Below 30 inches is yellow moderately compact cobbly clay loam mottled with gray and brown. Bedrock, usually shale, is at depths of 3 to 15 feet or more.

Some areas have a more sandy texture; the surface layer is cobbly fine sandy loam, and the subsoil is cobbly sandy clay loam. The stones common in this soil range from small pebbles to cobbles about 10 inches in diameter. Fertility and organic-matter content are low, but the soil is permeable and well drained, has a fairly good water-holding capacity, and does not have hazardous runoff. It responds well to proper management.

Areas are widely distributed over many of the moderate and high stream terraces along the French Broad and Nolichucky Rivers in the Holston-Monongahela-Tyler and Holston-Nolichucky-Dandridge soil associations. Some areas on the high terraces in the northern part of the county are 2 to 3 miles from the rivers. This soil is associated chiefly with less stony Holston, Monongahela, and in places, Dandridge soils.

Use suitability and management.—The smooth surface, good tilth, and favorable moisture relations make this a fairly desirable soil for

a wide variety of crops. It is mostly cleared and used for corn, tobacco, hay, and small grains (pl. 1, *B*). Yields are low to moderate. The cobblestones, however, interfere materially with cultivation and mowing. The soil responds well to proper management, but heavy fertilization is required to maintain high productivity. Some fertilizer is used for corn and small grains, and heavy applications are made for tobacco. For a discussion of use and management, see group 8 in the section on Use and Management of Soils.

Holston cobbly loam, rolling phase (5–12% slopes) (HK).—This soil differs from the undulating phase chiefly in having a stronger slope but also is having thinner surface soil and subsoil layers. It is associated with other Holston soils on stream terraces.

Use suitability and management.—All of this soil is in cut-over deciduous and pine forest, but it is suited to the crops commonly grown and to pasture. Substantial fertilization is required to improve and maintain productivity, and the moderately strong slopes make the soil notably subject to erosion when it is in cultivation. The cobblestones make cultivation, mowing, and other field operations difficult. Group 8 in the section on Use and Management of Soils includes this phase.

Holston cobbly loam, eroded rolling phase (5–12% slopes) (HG).—Areas of Holston cobbly loam that have a rolling surface and are sufficiently eroded to cause the plow layer in most places to be a mixture of surface and subsoil material are represented by this soil. The 5-inch surface layer is brownish-yellow cobbly loam that grades in places to clay loam. Below this is the brownish-yellow cobbly clay loam subsoil that grades at about 22 inches to mottled yellow, gray, and brown clay loam. Bedrock—shale in most places—is at depths of 2½ to 12 feet. This soil occurs chiefly with other Holston and Monongahela soils in the Holston-Monongahela-Tyler soil association.

Fertility and organic-matter content are low, and the reaction is medium to strongly acid. Runoff is a hazard where the soil is cultivated. The soil is permeable, and internal drainage is moderate. It has a fairly good capacity for holding moisture available to plants. Tilth is good, but the cobblestones interfere greatly with field operations.

Use suitability and management.—All of this phase has been cleared, and much is now used for corn and pasture. Some fertilizer is applied to row crops. Yields are not high, and pasture normally is not of high quality. Stoniness, low fertility, and moderately strong slope are unfavorable for crop production, though the soil is suited to crops. It is difficult to work and requires substantial fertilization and special measures for controlling runoff. If adequately limed, fertilized, and seeded, it is capable of supporting fairly good pasture. For further discussion, see group 8 in the section on Use and Management of Soils.

Holston cobbly loam, hilly phase (12–25% slopes) (HH).—The parent material of this hilly well-drained yellowish soil is old alluvium that came chiefly from shale and sandstone. Intermixed is material from limestone and, in some places, from micaceous rocks. The soil differs from Holston loam, eroded hilly phase, chiefly in having a considerable quantity of gravel and cobbles intermixed. The surface

8 inches is pale-yellow cobbly loam. Below is brownish-yellow firm but friable cobbly clay loam that grades to mottled yellow, gray, and brown, firm but friable clay loam. Bedrock, usually shale, is at depths of 1 to 10 feet. Shale outcrops are common in places. Areas occupy escarpment slopes of stream terraces in the Holston-Monongahela-Tyler and Holston-Nolichucky-Dandridge soil associations.

This soil is low in fertility and organic matter and medium to strongly acid. The surface layer has good tilth and moisture infiltration. The subsoil is sufficiently firm to retard percolation somewhat, but internal drainage is moderate. Cobblestones are numerous enough to interfere with many field operations.

Use suitability and management.—All of this hilly phase is in cutover deciduous forest with some pine intermixed. Because of its strong slope, low fertility, and cobbly nature, it is poorly suited to cultivation. Where crop acreage is very limited, however, it may be used. If properly fertilized and seeded, the soil is capable of supporting good pasture, but it is not so desirable as some of the more fertile soils. For a discussion of use and management, see group 16 in the section on Use and Management of Soils.

Holston cobbly loam, eroded hilly phase (12–25% slopes) (HF).—This soil consists of areas of the hilly phase so eroded that the plow layer in most places consists of a mixture of the original surface soil and subsoil. The 5-inch plow layer is brownish-yellow cobbly loam, and below this is brownish-yellow firm but friable cobbly clay loam. A part of the acreage is so severely eroded that the plow layer consists of brownish-yellow cobbly clay loam subsoil material. Bedrock, usually shale, is at depths of 1 to 10 feet, and there are some shale outcrops.

Fertility and organic-matter content are low, and the reaction is medium to strongly acid. Cobblestones and gravel interfere with many field operations. Tilth is fair to poor, depending on the quantity of surface soil that has been lost by erosion. Water-holding capacity is moderate to low, and in general the south-facing slopes are more droughty than the north-facing slopes. Most of the soil is on the escarpments or edges of the stream terraces in areas occupied by smoother Holston and Monongahela soils.

Use suitability and management.—All of this soil has been cleared and cropped at one time, but much of it now is in unimproved pasture or lies idle. Some acreage is used for corn and lespedeza, and some of the more severely eroded parts are revegetated with pine forest. Little is fertilized or limed, and pastures in general are of low quality and low carrying capacity. Strong slope, low fertility, and cobbly nature, make this soil poorly suited to crops, but it may be advisable to use it on some farms where there is none better. Its proper management for crop production, however, is very exacting, especially as to fertilization and supplementary runoff control practices. Group 16 of the section on Use and Management of Soils gives management suggestions for this eroded hilly phase.

Jefferson loam, eroded rolling phase (5–12% slopes) (JD).—This soil, like others of its series is yellowish, well-drained, and developed on old alluvial slopes or fans from material that came from acid sandy rocks. Quartzite and sandstone are the parent rocks in this county. This phase differs from Jefferson stony sandy loam chiefly in having

a finer textured surface soil and subsoil and less stone. Areas of this phase on the crests of the broader ridges have a slope of less than 5 percent.

The phase is in the Jefferson-Allen-Barbourville soil association; much of it occupies ridge tops in association with Dunmore soils in the proximity of mountains consisting of sandy Ramsey soils. In general, the Jefferson loam areas are farther out from the base of these mountains than are the Jefferson stony sandy and very stony sandy loams. The most extensive acreage is east of English Mountain and north of Meadow Creek Mountain.

Profile description:

0 to 6 inches, pale-yellow loam or clay loam.
6 to 24 inches, yellow or brownish-yellow firm but friable sandy clay or sandy clay loam.
24 inches +, yellowish-red firm silty clay with yellowish streaks; dolomitic limestone bedrock is usually at depths of 2½ to 9 feet.

The surface 6-inch layer consists of surface and subsoil material mixed as a result of erosion and cultivation. The small acreage still in cut-over native forest does not have the eroded and mixed surface layer but a layer of pale-yellow loam about 9 inches thick. In contrast, tracts in tilled areas have lost all the surface soil and part of the subsoil through erosion. In these places the plow layer is brownish-yellow sandy clay or yellowish-red silty clay, depending on the depth of erosion. Some cobbles may occur in the surface 24 inches. A small acreage is over shale or slate bedrock rather than limestone.

Fertility is not high but a little greater than for the more sandy types. Tilth is good, and the soil is permeable. It has a fairly high moisture-holding capacity, moderately rapid internal drainage, low organic-matter content, and a medium to strongly acid reaction.

Use suitability and management.—Most of the loam type has been cleared and is suited to crops and pasture. The smoother areas are suitable for truck crops. About 30 percent is used for corn and tobacco, 20 percent for small grains, and much of the rest for hay and pasture. A small area is in forest, and some is idle or abandoned. The soil requires substantial fertilization, organic matter, and moderately long rotations to maintain its productivity. Moderately intensive cropping is carried on in some areas for several years; these areas are then left idle for a few seasons. Other areas are rotated. Some fertilization is practiced, and lime has been applied to some fields. Tobacco is fertilized heavily. Legume-and-grass pastures are of fair to good quality, depending chiefly on the fertilization, liming, and seeding. Some of the more fertile silt loam and silty clay loam areas, however, support better stands under average conditions. For further discussion, see group 7 in the section on Use and Management of Soils.

Jefferson stony sandy loam, rolling phase (5–12% slopes) (JM).—Old alluvium consisting of material originating from quartzite and sandstone is the parent material for this yellowish well-drained sandy soil. A small acreage on the broader ridge tops has a slope of less than 5 percent. The areas occupy low ridges below the high mountainous areas of Ramsey soils in the Jefferson-Allen-Barbourville soil association. The most extensive acreage is east of English Mountain and north of Meadow Creek Mountain.

Profile description:

0 to 14 inches, pale-yellow sandy loam containing stones or cobbles that interfere with cultivation; surface 2 inches is darker brown and contains more organic matter than rest of layer.
14 to 24 inches, pale-yellow (yellowish-brown when moist), firm but friable sandy clay loam with a variable content of stones or cobbles; breaks to clods that are moderately easily crushed.
24 to 48 inches +, mottled or variegated yellow, brown, and gray moderately compact but brittle sandy clay loam; bedrock of limestone, shale, or slate is at depths of 3 to more than 15 feet.

Fertility and organic-matter content are low, and the reaction is medium to strongly acid. Internal drainage is moderately rapid, and the soil has good tilth and is permeable. It has a fair water-holding capacity. Stones interfere with cultivation.

Use suitability and management.—Practically all of the rolling phase is in cut-over deciduous forest, though it is suited to most crops locally grown. Although good tilth and permeability favor it for truck crops, its moderately strong slope and stoniness make less intensive use and moderately long rotations important in proper management. High yields require substantial fertilization. The more exacting legumes and grasses are suited, but good stands of high quality are more difficult to maintain than on some of the more fertile silt loam and silty clay loam soils. For a discussion of use and management, see group 8 in the section on Use and Management of Soils.

Jefferson stony sandy loam, eroded rolling phase (5–12% slopes) (JH).—This phase differs from the rolling phase of Jefferson stony sandy loam chiefly in being eroded. In most places the 5- or 6-inch plow layer is a mixture of original surface soil and subsoil. It is pale-yellow or yellowish-brown sandy loam. The subsoil is yellowish-brown firm but friable sandy clay loam, and bedrock is at depths of 2½ to 12 feet or more. Small areas have lost all the original surface soil and have a plow layer of yellowish-brown sandy clay loam. Cobbles and stones throughout interfere with cultivation. The soil occurs on the ridge crests of the rolling and hilly foot slopes in the Jefferson-Allen-Barbourville soil association; it is below high mountainous areas occupied by sandy Ramsey soils. Most of the acreage is in belts about three-fourths of a mile wide east of English Mountain and north of Meadow Creek Mountain.

This soil is low in fertility and organic matter and medium to strongly acid. Internal drainage is moderately rapid, water-holding capacity is fair, and tilth is good except where the plow layer consists mostly of subsoil material.

Use suitability and management.—Practically all of this soil is cleared and used for crops and pasture, but a small acreage is idle or abandoned. About 40 percent of the cleared land is used for corn, 35 percent for hay and pasture, and small percentages for small grains and tobacco. Permeability, responsiveness to fertilization, and good tilth favor use of this soil for truck crops and tobacco, but its stones interfere with tillage and mowing. It is not so desirable for the more exacting legumes and grasses as some of the more fertile silt loams and silty clay loams, but good stands of hay and pasture can be maintained with proper liming, fertilization, and seeding. For further information see group 8 in the section on Use and Management of Soils.

Jefferson stony sandy loam, hilly phase (12–25% slopes) (JL).—The parent material of this yellowish well-drained soil is old alluvium that came from acid sandy rocks, chiefly quartzite and sandstone. The soil is associated with the other Jefferson soils in the Jefferson-Allen-Barbourville soil association. It occupies stronger slopes on foothills or foot slopes below mountainous areas consisting of Ramsey soils. Much of it is on belts of old alluvium east of English Mountain and north of Meadow Creek Mountain. It differs from Jefferson stony sandy loam, rolling phase, chiefly in having a shallower depth to the underlying limestone or shale residuum or parent rocks. The 10-inch pale-yellow stony sandy loam surface soil contains cobbles or stones that interfere with cultivation. This layer is underlain by pale-yellow or yellowish-brown friable but moderately firm stony sandy clay loam. Below about 20 inches is variegated or mottled material, and limestone, shale, or slate bedrock is at depths of 2 to 12 feet or more. In a few places bedrock is near the surface.

The soil is low in fertility and organic matter and is medium to strongly acid. Moisture is absorbed readily, and the moisture-holding capacity is fair to moderate. A few small areas are so stony that cultivation is practically prohibited.

Use suitability and management.—Most of the hilly phase is in cut-over deciduous forest. Because of its low fertility, stoniness, and strong slope, it is poorly suited to crops requiring tillage. Under intensive management, however, it can be used in long crop rotations if there is a great need for cultivated land. It is not so productive of the more desirable pasture legumes and grasses as some of the more fertile soils, but fertilization, liming, and other proper management practices will maintain fairly good permanent pasture. For a discussion of use and management, see group 16 in the section on Use and Management of Soils.

Jefferson stony sandy loam, eroded hilly phase (12–25% slopes) (JG).—This phase has lost much original surface soil through erosion. The plow layer in most places now consists of a mixture of surface and subsoil; it is a pale-yellow or yellowish-brown stony sandy loam. Some areas have lost all of the original surface soil and now have a plow layer of yellowish-brown stony sandy clay loam. The subsoil, a yellowish-brown friable but moderately firm stony sandy clay loam, grades with depth to variegated yellow, brown, and gray. Bedrock or residuum from bedrock is at depths of 1½ to 12 feet or more.

This soil is low in fertility and organic matter and is medium to strongly acid. It is permeable, and its water-holding capacity is fair. As with the hilly phase, stones or cobbles interfere with cultivation. The soil is associated with the other Jefferson soils in the Jefferson-Allen-Barbourville association. It occurs on old foot slopes below the mountainous areas occupied by Ramsey soils and Ramsey soil material.

Use suitability and management.—Most of this eroded hilly phase has been cleared and cropped at one time. Much is used for corn and lespedeza, and some for tobacco, truck crops, and small grains. A significant acreage is in pasture, and some areas are idle. The common practice is to crop a field for a period of years, than allow it to lie idle for several years, and begin another period of cropping after

that. Fertilizer and lime are applied to some areas, but under common management yields are low.

Because of the low fertility, stoniness, and strong slope, this soil is poorly suited to crops. Unless the soil is carefully managed, runoff is a hazard. Long rotations and other soil-conserving measures should be used on areas that must be cropped. This soil is not so well suited to the more desirable legumes and grasses; their quality and carrying capacity are low under common management. Fairly good pasture can be maintained, however, where considerable effort is made to bring the fertility to a high level and the proper plants are seeded. For a discussion of use and management, see group 16 in the section on Use and Management of Soils.

Jefferson stony sandy loam, eroded steep phase (25–50% slopes) (JK).—This phase differs from the hilly phase chiefly in having stronger slopes and in being eroded. The degree of erosion varies widely. In some places the plow layer is a mixture of original surface soil and subsoil material, and in others it consists entirely of the yellowish-brown moderately firm but friable stony sandy clay loam subsoil material. Limestone, shale, or slate bedrock is at depths of 1 to about 8 feet, and there may be an occasional rock outcrop.

Fertility is low, and the reaction is medium to strongly acid. The soil is moderately permeable, but moisture-holding capacity is limited. Stones and cobbles are scattered throughout the entire soil mass. Gullies are common, though few exceed 2 feet in depth. Areas occur in association with those of other Jefferson soils. They occupy narrow strips on the strongest slopes and foothills in the Jefferson-Allen-Barbourville soil association. They occur below mountainous areas of Ramsey soils.

Use suitability and management.—All of the eroded steep phase was cleared at one time, and a great part is now either idle or abandoned. Some is used for unimproved pasture, most of which is of poor quality and low carrying capacity. A few small areas are cropped, but yields are low. Because of the very strong slope, stoniness, and low fertility, this soil is poorly suited to either crops or pasture. All areas should be returned to forest where conditions will permit. For further discussion see group 19 in the section on Use and Management of Soils.

Jefferson stony sandy clay loam, severely eroded rolling phase (5–12% slopes) (JF).—In this phase are areas from which erosion has removed practically all of the original surface soil and, in places, part of the subsoil. The 5- or 6-inch plow layer consists of pale-yellow or yellowish-brown friable but moderately firm sandy clay loam. Below about 18 inches is variegated or mottled yellowish-brown and gray brittle sandy clay loam. Bedrock of limestone, shale, or slate is at 2 to 10 feet or more. A few small gullies occur, but most of them can be obliterated without great difficulty. Cobbles or stones are throughout the soil to interfere with field operations. A small area is too stony for cultivation. Most of the soil is in narrow strips associated with other Jefferson soils in the Jefferson-Allen-Barbourville soil association.

This soil is slow in fertility and organic matter and medium to strongly acid. Its tilth is much less favorable than that of the less

eroded Jefferson soils, and it absorbs moisture more slowly. Water-holding capacity is medium.

Use suitability and management.—All of this soil has been cleared and cropped at some time. Much is now used as unimproved pasture, parts are in crops (chiefly corn and hay), and a considerable acreage is idle or abandoned. Management varies greatly—a small area has been improved for crop production; other areas are still under a low level of management. Yields are generally low, and the quality and carrying capacity of pastures are low.

Unfavorable tilth, susceptibility to erosion, low fertility, and relatively unfavorable moisture relations limit the suitability of this soil for crops and its ability to produce high yields. With a high level of management, including adequate fertilization and runoff control, the soil is suited to most general farm crops if they are grown in long rotations. High yields cannot be expected until after a relatively long period of improvement. Group 9 in the section on Use and Management of Soils includes this phase.

Jefferson stony sandy clay loam, severely eroded hilly phase (12–25% slopes) (JE).—This phase has been so eroded that practically all of the original surface soil and, in places, part of the subsoil have been lost. The plow layer now consists of yellowish-brown friable but moderately firm stony sandy clay loam that grades to variegated or weakly mottled yellow, brown, and gray firm but friable and brittle stony sandy clay loam at about 20 inches. Small gullies are common, but practically all of them can be obliterated by heavy tillage implements or by limited filling.

This soil is low in fertility and organic matter and medium to strongly acid. Moisture penetrates much more slowly than in the less eroded phases. The low water-holding capacity causes the soil to be droughty. The soil is associated with other Jefferson soils on slopes of the low ridges in the Jefferson-Allen-Barbourville association.

Use suitability and management.—All of the severely eroded hilly phase has ben cleared and cultivated at some time, but much of it is now idle, abandoned, or used as unimproved pasture. A small part can be used for crops, chiefly corn, but yields are low. Unfavorable tilth, low fertility, stoniness, and strong slope make this soil poorly suited to crops. The quality and carrying capacity of pastures are very low. Even with proper fertilization, its carrying capacity is more limited than that of the less eroded Jefferson soils because of its less favorable moisture relations. Where required for crops, the soil can be improved to a fairly productive state, but it cannot be intensively cropped, as it is easily eroded. For a discussion of use and management, see group 16 in the section on Use and Management of Soils.

Jefferson very stony sandy loam, rolling phase (5–12% slopes) (Js).—This phase differs from Jefferson stony sandy loam, rolling phase, chiefly in being more stony. The cobbles and stones range from very small to about 10 inches in diameter and are sufficiently abundant to interfere with cultivation. The surface 10 or 12 inches is pale-yellow very stony sandy loam. A high organic-matter content of partly disintegrated leaves and roots makes the surface 1½ or 2 inches notably darker. The subsoil is pale-yellow or yellowish-brown mod-

erately firm but friable sandy clay loam with a variable content of stone. Below a depth of about 24 inches the material is variegated or mottled yellow, brown, and gray moderately compact but brittle and friable sandy clay loam containing a variable quantity of cobbles and stone fragments. Limestone, shale, or slate bedrock is at 3 to 15 feet or more.

Fertility and organic-matter content are low, and the reaction is medium to strongly acid. The soil is notably permeable, but water-holding capacity is limited. Areas occupy the ridge tops in the Jefferson-Allen-Barbourville soil association; they are below mountainous areas of Ramsey soils and Ramsey soil materials. Associated are other Jefferson soils.

Use suitability and management.—The rolling phase is all in cut-over deciduous forest. The great abundance of stones would make it very difficult to till if cleared, and much of it probably can be best used for pasture. Except for the difficulty of cultivation, mowing, and other field operations, it is fairly well suited to many crops and rotations of moderate length. Corn, tobacco, cabbage, small grains, and some of the grasses and legumes are adapted, but good yields require substantial fertilization. Removal of the larger stones would improve workability, but this is an expensive operation under most circumstances. Adequate lime and fertilizer and proper seeding should produce fairly good pasture on most areas. For further discussion, refer to group 16 in the section on Use and Management of Soils.

Jefferson very stony sandy loam, eroded rolling phase (5–12% slopes) (Jo).—In this phase are former areas of the rolling phase that have been eroded to the extent that the plow layer now consists of a mixture of original surface soil and subsoil materials. The 5-inch plow layer is pale-yellow or yellow very stony sandy loam, and the underlying material is similar to that of the rolling phase. Bedrock of limestone, shale, or slate is at depths of 3 to 15 feet or more. A small acreage has lost all the surface soil and some of the subsoil and now has a plow layer consisting of yellowish-brown very stony sandy clay loam.

Fertility and organic-matter content are low, the reaction is medium to strongly acid, and water-holding capacity is fair to good. Internal drainage is moderate, and moisture infiltrates easily. The soil is associated with other Jefferson soils and occupies ridge tops in the Jefferson-Allen-Barbourville soil association. It is below the mountainous areas of Ramsey soils. Much of the acreage is in belts about three-fourths of a mile wide east of English Mountain and north of Meadow Creek Mountain.

Use suitability and management.—All of this soil was cleared and used for crops at one time. Some is now in corn and tobacco, a considerable acreage is in pasture, and some areas are idle. Most pasture contains broomsedge, lespedeza, and such trees as sassafras and persimmon. The productivity of most pastures is low. The high stone content causes very difficult workability, and most areas are probably best used for pasture. Except for the difficult workability, the soil is fairly well suited to many crops and to rotations of moderate length. With adequate fertilization and liming and

proper seeding, pasture and many of the crops commonly grown would give fair yields. Group 16 in the section on Use and Management of Soils includes this eroded rolling phase.

Jefferson very stony sandy loam, hilly phase (12–25% slopes) (JR).—Slope is the chief difference between this and the rolling phase. The 8- or 10-inch surface soil consists of pale-yellow very stony sandy loam. It is underlain by yellowish-brown moderately firm but friable stony sandy clay loam, which grades to variegated or somewhat mottled yellow, brown, and gray firm but brittle and friable stony sandy loam or clay loam. Bedrock of limestone, shale, slate, or residuum from these, is at depths of 2 to 12 feet or more.

Fertility is low, and there is little organic matter in the surface layer. The reaction is medium to strongly acid. The soil is permeable and has a fair to moderate water-holding capacity and moderate internal drainage. It occurs in fairly large tracts in association with other Jefferson soils in the Jefferson-Allen-Barbourville soil association. It lies below mountainous areas of Ramsey soils.

Use suitability and management.—Cut-over deciduous forest covers most of the acreage. Crops requiring tillage are poorly suited because the high stone content and strong slope make cultivation very difficult. The soil is capable of supporting pasture vegetation, but it must be heavily fertilized and limed to maintain high quality grazing. See group 16 in the section on Use and Management of Soils for further information on management of this soil.

Jefferson very stony sandy loam, eroded hilly phase (12–25% slopes) (JN).—This phase represents former areas of the hilly phase from which erosion has removed part of the surface layer. The 4- or 5-inch plow layer in most places is a mixture of original surface soil with subsoil material; it consists of brownish-yellow friable very stony sandy loam. The underlying material grades to variegated or somewhat mottled yellow, brown, and gray firm but brittle and friable stony or very stony sandy clay loam. About 10 percent of the acreage has lost all of the original surface soil, and the plow layer consists of the yellowish-brown firm sandy clay loam subsoil material. Bedrock of limestone, shale, slate, or residuum from these rocks, is at depths of 1 to 10 feet.

Fertility and organic-matter content are low, and the reaction is medium to strongly acid. Tilth is favorable, except on the more eroded areas, where the soil is cloddy and puddles easily when wet. Infiltration of moisture is much slower and water-holding capacity is lower than for the less eroded areas. This soil occurs in moderate-sized tracts in association with others of the Jefferson series. It is in the Jefferson-Allen-Barbourville soil association and lies below mountainous areas of Ramsey soils.

Use suitability and management.—All of the eroded hilly phase was cleared and cropped at one time. Many areas are now used for pasture; some areas, especially the more severely eroded ones, have reverted to forest; and some are cultivated. Crop yields are low, and most pasture is of poor quality and low carrying capacity. Extreme stoniness and strong slope make this soil poor for crops requiring tillage. It is capable of supporting good quality pasture, but heavy fertilization and liming are required. Pastures are less productive on the severely eroded areas because they are more droughty. Fur-

ther discussion of the management of this phase is in group 16 in the section on Use and Management of Soils.

Jefferson very stony sandy loam, steep phase (25–50% slopes) (JT).—This phase differs from the hilly phase of Jefferson very stony sandy loam chiefly in stronger slope but also in having less depth to bedrock. The individual areas are larger than those of the less steep Jefferson soils and occur in the Jefferson-Allen-Barbourville soil association; they are below steep mountainous areas of Ramsey soils.

Use suitability and management.—Because of its strong slope and extreme stoniness, this soil is poorly suited to crops and is all in cut-over deciduous forest. Although it might support fairly good pasture under good management, it is probably best kept in forest, the quality of which is fair to good. See group 16 in the section on Use and Management of Soils for further information on management of this soil.

Jefferson very stony sandy loam, eroded steep phase (25–50% slopes) (JP).—This soil differs from the hilly phase chiefly in having stronger slopes and in having lost some or all of the surface soil through erosion. In some places the plow layer consists of a mixture of original surface soil and subsoil material; and in others it consists entirely of the yellowish-brown very stony sandy clay loam subsoil material. Bedrock is usually at depths of 1 to 8 feet.

This soil is permeable, low in fertility and organic matter, medium to strongly acid, and moderate in water-holding capacity. It contains many cobbles and stones. It is associated chiefly with the steep phase and lies directly below the mountainous areas of Ramsey soils.

Use suitability and management.—All of the eroded steep phase has been cleared, and most of it has been cropped at one time. Some is now in reestablished pine forest, and most of the rest is either idle or in unimproved pasture. Its strong slope and very high stone content make it poor for crops. It should support fairly good pasture if well managed. Many areas, especially the more eroded ones and those that have a valuable forest cover developing on them now, are probably best used for timber production. For the further discussion of management see group 16 in the section on Use and Management of Soils.

Jefferson-Dunmore complex, hilly phases (12–25% slopes) (JB).—This complex represents hilly areas in which there is a thin, broken covering of old local alluvium that came from Ramsey soils or Ramsey soil material and was deposited over Dunmore soil material or residuum from limestone. The alluvium is 1 to 2 feet thick, and the profile is similar to that of Jefferson loam, eroded rolling phase. The 6-inch surface soil is pale-yellow loam with a notable content of organic matter in the first inch or so. The subsoil to a depth of 24 inches is brownish-yellow firm but friable sandy clay or sandy clay loam. Below this it is yellowish-red firm silty clay with yellow streaks. Where the alluvium is absent, the soil is almost identical to Dunmore silt loam, rolling phase, except some sandy material is intermixed with the surface layer. Gravel and cobblestones occur on the surface in many places.

The fertility varies, but in most places it is fair to moderate. Percolation is rapid where the local alluvium is thicker and moderately

slow where the Dunmore soil material is at the surface. Tilth varies from very good to good, depending on the quantity of sandy material in the plow layer. Organic-matter content is low, and the reaction is medium to strongly acid. Areas are small and are associated with areas of Jefferson loam soils in the Jefferson-Allen-Barbourville soil association. In general, they are not so close to the steep mountainous slopes as areas of the Jefferson very stony sandy loam soils.

Use suitability and management.—This complex is still in native forest. It is suited to limited cultivation, but strong slopes and slow percolation in areas where the Dunmore soil material is at the surface make it unsuited to intensive cultivation. It is well suited to pasture, and much of the acreage could be used for this purpose rather than for crops. For a discussion of use and management, see group 11 in the section on Use and Management of Soils.

Jefferson-Dunmore complex, eroded hilly phases (12–25% slopes) (JA).—These phases were cleared and cultivated at one time and have lost a part of the surface soil through erosion. The plow layer, a mixture of original surface soil and subsoil materials, ranges from yellow stony sandy loam to reddish-yellow silty clay loam. The subsoil in places is yellowish-brown friable sandy clay loam to a depth of 18 inches and in other places it is yellowish-red firm silty clay. Limestone bedrock is at depths of 2 to 9 feet.

There are some stones and cobbles in the surface layer and a few small gullies. Internal drainage is moderately slow. Fertility and organic-matter content are low, and the reaction is medium to strongly acid. Water-holding capacity is moderate; moisture percolates moderately rapidly in the more sandy parts and more slowly where the plow layer consists of silty clay loam Dunmore soil material. The complex is associated chiefly with the Jefferson loam soils in the Jefferson-Allen-Barbourville soil association.

Use suitability and management.—All this complex has been cleared and cultivated, and a part is cropped at present. Much is used for pasture. It is a common practice to crop areas for several years and then allow them to lie idle for a time. Lime has been applied to much of the acreage, and some fertilizer is used on corn and small grains.

This complex is suited to crops, but the strong slope and moderately slow permeability of the Dunmore soil material require that long rotations consisting chiefly of close-growing small grains and hay be used. It is capable of producing good pasture where properly managed, and on many farms it is likely that a great part can be used as permanent grass-and-legume pasture. For further discussion see group 11 in the section on Use and Management of Soils.

Jefferson-Dunmore complex, severely eroded hilly phases (12–25% slopes) (JC).—These phases consist of former areas of the hilly Jefferson-Dunmore complex from which erosion has removed practically all of the original surface soil and in places part of the subsoil. Where there is sandy alluvium, the plow layer and upper subsoil consist of yellowish-brown moderately friable sandy clay loam underlain at 8 to 20 inches by yellowish-red firm silty clay. Where the alluvium is absent, the reddish-yellow silty clay is at the surface. Limestone bedrock is usually at depths of 2 to 7 feet.

Cobbles and stones commonly occur on the surface but are not numerous. Gullies are common except in cultivated areas, and even

they may have a few. Several gullies are too deep to cross with machinery. Fertility and organic-matter content are low, and the reaction is medium to strongly acid. Rate of infiltration and water-holding capacity are low and tilth is poor. The separate areas are small. They are associated with areas of Jefferson soil in the Jefferson-Allen-Barbourville soil association east of English Mountain and north of Meadow Creek Mountain.

Use suitability and management.—All of this complex has been cleared and cropped at one time. Much of it is now idle or in unimproved permanent pasture, some is reforested with pine, and very little is cropped. It is not in a productive state. Because of the strong slope, unfavorable moisture relations, and poor tilth it is poorly suited to crops. It would support fair pasture if properly limed, fertilized, and seeded. Droughtiness, however, greatly limits its productivity for pasture during the drier parts of the growing season. See group 15 in the section on Use and Management of Soils for further discussion of management.

Leadvale silt loam, undulating phase (2–5% slopes) (LB).—This yellow moderately well-drained soil occupies the higher colluvial slopes in association with the Dandridge, Litz, and Ramsey soils, which are underlain by shale or slaty material. Areas are associated with Barbourville silt loam and Whitesburg silt loam on the lower lying younger alluvium. The Leadville soil is distinguished from the Barbourville and Whitesburg soils by its better developed firmer subsoil. It is widely distributed throughout the Dandridge-Leadvale-Hamblen soil association.

Profile description:

0 to 6 inches, pale-yellow or very pale-brown mellow silt loam.
6 to 15 inches, light yellowish-brown firm but friable silt loam or silty clay loam.
15 to 24 inches, yellow firm silty clay loam.
24 inches +, mottled yellow and gray firm but somewhat friable silty clay loam; shale bedrock is usually at depths of 3 to 10 feet.

Natural fertility is low, and there is little organic matter in the surface layer. The reaction is medium to strongly acid. The soil is moderately permeable but its lower subsoil retards percolation, and mottling indicates that internal drainage is less favorable than in the Dewey, Allen, and Jefferson soils. The moisture-holding capacity is relatively favorable. Many areas have especially favorable moisture relations for late-season crops because they receive seepage and runoff from adjacent higher areas. Erosion is not a great hazard.

Use suitability and management.—Practically all of this soil is cleared. About 30 percent is used for corn, 25 percent for small grains (chiefly wheat), and most of the rest for pasture (principally lespedeza and broomsedge) and hay (chiefly lespedeza and redtop). Some fertilization is practiced. Although its natural fertility is not high, the soil responds well to good management. It is probably best suited to small grains and hay, but corn and tobacco yield well under good management. Impaired internal drainage and low fertility make this soil somewhat less well suited to alfalfa than some other soils of the county. For a discussion of use and management, see group 5 in the section on Use and Management of Soils.

Leadvale silt loam, rolling phase (5–12% slopes) (La).—This soil differs from the undulating phase chiefly in having stronger slopes. The surface layer may be somewhat thinner, and erosion has exposed the subsoil in places. The acreage is widely distributed throughout the Dandridge-Leadville-Hamblen soil association. Much of it occurs at the base of hilly and steep upland areas; strips of bottom land lie below it. Typically, the 5- or 6-inch surface layer is pale-yellow or very pale-brown mellow silt loam. It is underlain by yellow firm silty clay loam that grades at 20 inches to mottled yellow and gray very firm silty clay loam or silty clay. The more eroded areas have lost all of the surface layer, and the plow layer is yellow silty clay loam. Bedrock is at 2 to 7 feet.

Natural fertility is low, as is organic-matter content in places. The reaction is medium to strongly acid. Tilth ranges from good to poor, depending on the quantity of original silt loam surface layer that has been lost by erosion. The soil is permeable to a depth of about 20 inches, below which percolation is notably retarded by the firmness of the deep subsoil. Moisture relations vary. In some places they are favorable for plants, but in more exposed areas a more droughty condition prevails. Erosion is active on much of this soil.

Use suitability and management.—Low fertility and moderately strong slope limit the range of suitability. The soil is suited only to moderately long rotations. The more exacting crops such as alfalfa and tobacco are less well suited than corn, small grains, and the less exacting legumes and grasses. Where a relatively high state of fertility is attained, such hay crops as red clover and orchard grass are suited. Good pasture can be maintained only after the fertility has been improved, and under average conditions the less exacting legumes and grasses such as lespedeza and redtop are better suited. For further discussion see group 5 in the section on Use and Management of Soils.

Lindside silt loam (0–2% slopes (Lc).—This brown or light-brown imperfectly drained soil on bottom lands consists largely of alluvium originating largely from limestone. It occurs along creeks, chiefly within the Dunmore-Greendale soil association. Most areas are narrow, and along the smaller creeks they occupy the entire bottom land. Practically all of the acreage is subject to overflow. The surface is normally nearly level, but in places along the streams of strong gradient it has a very gentle slope.

Profile description:

> 0 to 16 inches, grayish-brown or light yellowish-brown mellow silt loam.
> 16 to 30 inches, mottled gray and light yellowish-brown friable heavy silt loam; below 30 inches, gray becomes more dominant and the texture may become silty clay loam; limestone bedrock at depths of 3 to 10 feet.

In places there is a 4- to 6-inch dark-brown silt loam layer at depths of 8 to 15 inches. This layer is an original surface layer covered by recent deposition. Included with this soil are a few small areas of Melvin silt loam, a gray poorly drained soil that is too limited in acreage to be shown separately on the map. These areas have a gray silt loam surface layer and a gray, mottled with yellow and brown, silt loam or silty clay loam subsoil. They occupy gentle depressions, and the water table is at or within a few inches of the surface much of the time. They are designated by wet-spot symbol. Another

variation or inclusion contains considerable chert throughout. In a few places the chert may be abundant enough to interfere with field operations, especially hand cultivation.

Lindside silt loam is one of the more fertile soils in the county; it has a moderately high organic-matter content. It is normally slightly acid to neutral but is medium acid in some places. It is permeable and has a great capacity for holding moisture available to plants. These qualities, along with the relatively shallow depth to the water table, give this soil particularly favorable moisture relations for crops that need a long growing season. The tilth is good in most places, but the exceptionally wet parts may be somewhat plastic. Tillage operations and other field work, however, are commonly delayed in the spring by wetness and at times during the growing season by heavy summer rains. Floods during the growing season may materially damage crops.

Use suitability and management.—Practically all of Lindside silt loam has been cleared for crops and pasture. Probably one-third is used for corn, one-third for hay, and one-fourth for pasture. A very small acreage of small grains and other crops is grown. Because of the smooth surface, high fertility, and good tilth, this soil is well suited to intensive use. Its range of suitability for crops, however, is somewhat limited. Alfalfa and tobacco are not adapted because of the relatively moist subsoil, and truck and other high-value crops are not well suited because of the flood hazard during the growing season. This one of the best soils for permanent pasture, for it supports high quality forage and its good moisture relations favor the growth of vegetation through much of the driest part of the growing season. For further discussion see group 1 in the section on Use and Management of Soils.

Litz shaly silt loam, steep phase (25–60% slopes) (Lf).—Shale interbedded with limestone or shaly limestone underlies this shallow light-colored soil of the uplands. A great part occurs as a narrow, steep, sloping, sharp ridge in the eastern part of the county east of Parrottsville.

Profile description:

0 to 4 inches, grayish-yellow shaly silt loam.
4 to 12 inches, light yellowish-brown firm moderately compact but friable shaly silt loam or silty clay loam, underlain by predominantly gray, pale-olive, and brown shale bedrock.

In places the surface layer may be 6 to 8 inches thick; in the more eroded parts, however, bedrock may be within a very few inches of the surface or even outcropping.

This soil is very low in plant nutrients and organic matter and is medium to strongly acid. The shale is so abundant in most places that tillage is difficult but it can be broken by heavy implements to the extent that will permit tillage. Moisture percolates into the shale fairly well, but the moisture-holding capacity is low. During rains the strong slope causes runoff to develop quickly.

Use suitability and management.—A part of the steep phase is still forested; the rest has been cleared and cropped at one time and is now mostly in pasture or idle. Little is cropped and yields are very low. Crops are poorly suited because of the strong slope and high shale content. The soil is capable of supporting some pasture, but the carrying

capacity cannot be expected to be high because moisture relations are relatively unfavorable, especially during the drier parts of the year. Most of the acreage is best used for forest. For further discussion see group 17 in the section on Use and Management of Soils.

Litz shaly silt loam, eroded hilly phase (12–25% slopes) (LD).—This phase differs from the steep phase of Litz shaly silt loam chiefly in slope. The 4- or 5-inch surface layer, a grayish-yellow shaly silt loam, grades to light yellowish-brown firm and moderately compact but friable shaly silt loam or silty clay loam. Shale bedrock is at depths of 6 to 18 inches. In the more eroded areas, however, the shale is within a very few inches of the surface and it outcrops in places. This phase is associated with the other Litz soils on a few steep sharp ridges in the extreme eastern part of the county east of Parrottsville.

Natural fertility, organic-matter content, and water-holding capacity are low. The shale makes tillage difficult, especially for light implements. The strong slope causes runoff to develop rapidly during rains and hinders field operations.

Use suitability and management.—Probably one-third of this soil is in native forest. The rest has been cleared and cropped at one time. Much is now used for pasture, a small part is cropland, and the rest is idle. Corn and hay, the chief crops, produce low yields. Crops and pasture are poorly suited because of the low fertility, poor tilth, and unfavorable moisture conditions. Where adequately fertilized, the soil is capable of producing some pasture, but growth is retarded during dry weather. Much of this land is best used for forest. Group 17 in the section on Use and Management of Soils discusses management for soils of this kind.

Litz shaly silt loam, eroded rolling phase (5–12% slopes) (LE).—This phase differs from the steep phase chiefly in slope. The grayish-yellow shaly silt loam surface layer is a little thicker in places, and the depth to shale bedrock varies from a few inches to approximately 18. This soil is closely associated with the other Litz soils on steep narrow ridges in the extreme eastern part of the county east of Parrottsville. It occurs chiefly on ridge crests, and the steeper Litz soils are on the slopes.

Natural fertility, organic-matter content, and the moisture-holding capacity are low. The shale interferes with cultivation.

Use suitability and management.—A small part of this soil is still in native forest, 10 to 20 percent is idle, and most of the rest is in unimproved pasture. Little is cropped. Small grains and the less exacting legumes and hay crops might be suited, but heavy fertilization would be required and yields would not be high. With proper fertilization, the soil is suited to certain pasture grasses and legumes. The low supply of available moisture and the low fertility, however, limit the carrying capacity. For further discussion refer to group 12 in the section on Use and Management of Soils.

Monongahela silt loam (1–5% slopes) (MA).—The parent material of this imperfectly drained soil is old alluvium, much of which is from shale, slate, and sandy rocks. Some of the alluvium, however, is from limestone and some from micaceous rocks. The soil is distinguished from Holston loam, undulating phase, chiefly by poorer drainage, which is shown by a lighter yellow subsoil and a shallower depth to mottled material. The soil occurs in the Holston-Mononga-

hela-Tyler soil association, much of it near Rankin on stream terraces 10 to 30 feet above the adjoining bottom lands. A small part is on the higher terraces in this part of the county.

Profile description:

0 to 12 inches, white to pale-brown silt loam.
12 to 22 inches, pale-yellow friable silty clay loam.
22 to 36 inches, mottled yellow and gray compact silty clay loam or silty clay, underlain by material that is mottled but somewhat less compact; bedrock, mostly shale, occurs at depths of 3 to 10 feet.

A few areas on some of the low stream terraces have a 16-inch dark grayish-brown silt loam surface layer grading with depth to grayish-brown. Below this is mottled yellow, gray, and brown compact silty clay loam or silty clay. A few areas of Monongahela silt loam contain some cobbles, in places enough to interfere with cultivation.

Monongahela silt loam is low in fertility and organic matter and medium to strongly acid. Tilth is good, but percolation is slow and the soil is too wet to cultivate for much longer periods than the well-drained soils. Available moisture is moderately high, but moisture relations are generally not good. Part of the time the soil is too wet for optimum growth, and during the driest periods plant growth is retarded by lack of water. The soil responds to proper fertilization and liming. It is slightly subject to erosion.

Use suitability and management.—Most of Monongahela silt loam has been cleared and is used for crops or pasture. Corn, wheat, and lespedeza are the chief crops, and yields are moderate. Some fertilizer is used on corn and wheat, and lime has been applied to most of the cleared areas. Imperfect drainage and compact subsoil limit the range of crops, but small grains, grasses, and lespedeza sericea, white and alsike clovers, and in places red clover are suited. Most pasture is not of high quality, though good stands can be maintained with proper fertilization. Winter grazing is not practical, as the soil remains too wet to withstand trampling by animals, and vegetation grows more slowly during the cooler months than on the better drained soils. For a discussion of use and management, see group 5 in the section on Use and Management of Soils.

Monongahela silt loam, eroded phase (2–5% slopes) (MB).—This phase has been eroded. The plow layer now consists of a mixture of the surface soil and subsoil material. The 5-inch surface soil, a pale-yellow silt loam, is underlain by about 16 inches of pale-yellow friable silty clay loam. The plow layer in some areas has more subsoil material intermixed and has a silty clay loam texture. A few areas have slopes up to 12 percent, and a few contain cobbles in numbers that interfere with cultivation.

The soil is low in fertility and organic matter and is medium to strongly acid. Its tilth is good but somewhat less favorable than that of Monongahela silt loam. Available moisture is moderately high, but moisture relations generally are not good. The soil is too wet for optimum plant growth part of the time, and during the driest periods growth is retarded. The soil responds to proper fertilization and liming, and most of it is only moderately subject to erosion. Most of the acreage is in the Holston-Monongahela-Tyler soil association. A small area was inundated by the Douglas Reservoir.

Use suitability and management.—All of this eroded phase has been cleared and cropped, chiefly to corn. Much is now used for permanent

pasture or is idle. Some fertilization is practiced, but yields are usually low. Imperfect drainage and compact subsoil limit the range of crops to which this soil is suited. Small grains, grasses, and certain legumes—lespedeza, lespedeza sericea, white and alsike clovers, and in places red clover—are suited. With proper fertilization, fairly good stands of pasture plants can be maintained. Refer to group 5 in the section on Use and Management of Soils for management practices suitable for this phase.

Nolichucky loam, undulating phase (2–5% slopes) (NL).—This soil, like other Nolichucky soils, has a light-colored surface layer and a light-red friable subsoil and was developed on old alluvium. Waynesboro soils differ from Nolichucky soils in having a browner surface soil and a somewhat redder subsoil. Soils of both series are on high stream terraces, mostly along the French Broad and Nolichucky Rivers. This and other Nolichucky soils are mapped in the Waynesboro-Nolichucky-Dunmore and Holston-Nolichucky-Dandridge soil associations.

Profile description:

0 to 9 inches, very pale-brown loam.
9 to 15 inches, yellow or pale-yellow loam.
15 to 36 inches, reddish-yellow or strong-brown firm but friable sandy clay loam.
36 inches +, variegated or mottled yellow, reddish-yellow, and gray brittle sandy clay or sandy clay loam; shale or limestone bedrock is at depths of 3 to 15 feet.

A few cobblestones occur in places. The areas over limestone have a somewhat darker surface layer and redder subsoil.

This soil is low in fertility and organic matter and is medium to strongly acid. Internal drainage is moderate, and water-holding capacity is fairly good. Tilth is good, and with the smooth surface, makes the soil easy to work and to conserve.

Use suitability and management.—A small part of this undulating phase is in cut-over deciduous forest, but most of it is cleared and cropped. Corn, small grains, lespedeza, red clover, tobacco, and other general farm crops predominate. These and many truck crops are well suited because of the smooth relief, good tilth, and good internal drainage. Some fertilizer is applied for corn and small grains, and heavy applications are made for tobacco. Most of the acreage has been limed. The soil responds well to fertilization and produces moderate to high yields under good management, especially in areas over limestone. For further discussion, refer to group 4 in the section on Use and Management of Soils.

Nolichucky loam, eroded rolling phase (5–12% slopes) (NH).—This phase differs from the undulating phase chiefly in stronger slope and in erosion. The 5- or 6-inch surface layer is pale-brown or brownish-yellow loam. Below this is firm but friable sandy clay loam material that grades from yellow to reddish yellow. Below 30 inches is brittle sandy clay or sandy clay loam variegated or mottled with yellow, reddish yellow, and gray. Shale or limestone bedrock is generally at 2 to 12 feet. Areas are small and occur in association with areas of Holston and Waynesboro soils in the Waynesboro-Nolichucky-Dunmore and Holston-Nolichucky-Dandridge soil associations. Small included areas on the ridge tops have a slope of less than 5 percent.

Cobbles and gravel occur in places, but do not interfere with cultivation.

Fertility and organic-matter content are low in areas over shale but moderate in areas over limestone. Reaction is medium to strongly acid. Tilth of the surface layer is good in most places, but in some of the more eroded parts sufficient subsoil material is intermixed to make the plow layer somewhat intractable. Runoff is an erosion hazard in cultivated areas. Moisture infiltrates fairly rapidly, however, and the supply of available moisture is moderately high.

Use suitability and management.—Practically all of this soil has been cleared, and most is used for crops or pasture. Corn, small grain, lespedeza, and tobacco are the chief crops and yields are moderate. A small acreage is in truck crops. Some fertilizer is applied to the corn and small grains, and much of the acreage has been limed. This soil is desirable for crops as it is easily worked, responds well to good management, and is suited to a wide variety of crops. Where well managed, it can support a 4-year rotation. If adequately fertilized, especially in areas of the Waynesboro-Nolichucky-Dunmore association, it is capable of supporting a good stand of high quality legumes and grasses for pasture. Further information on management will be found in group 6 in the section on Use and Management of Soils.

Nolichucky loam, hilly phase (12–25% slopes) (NK).—Slope is the chief difference between this soil and the undulating phase. This phase also is shallower to bedrock and, in places, especially on lower parts of the slopes, the residuum from the underlying rock may outcrop. In general the 6-inch surface layer is very pale-brown loam that grades to yellow or pale-yellow loam. Below about 10 inches is reddish-yellow firm but friable sandy clay loam that grades at a depth of 20 inches to sandy clay or sandy clay loam variegated or mottled with yellow, reddish-yellow, and gray. The soil is associated with smoother Nolichucky, Waynesboro, and Holston soils in the Waynesboro-Nolichucky-Dunmore and Holston-Nolichucky-Dandridge soil associations.

The few cobbles on the surface do not interfere much with cultivation. The soil is low in fertility and organic matter and medium to strongly acid. It has good tilth, however, and moisture infiltrates moderately rapidly. Supplies of available moisture are moderately high. Runoff develops rapidly and creates an erosion hazard in cultivated areas.

Use suitability and management.—Most of this soil is in cut-over deciduous forest. It is considered suitable for crops but is rather exacting in its management requirements because of its strong slope. Long rotations consisting chiefly of small grains and legumes and grasses are required to maintain productivity. The soil responds well to fertilization and is capable of producing moderately high yields under good management. Refer to group 11 in the section on Use and Management of Soils for further information on management.

Nolichucky loam, eroded hilly phase (12–25% slopes) (NG).—This soil differs from Nolichucky loam, undulating phase, chiefly in being eroded and hilly. The 5- or 6-inch surface layer is pale-brown or brownish-yellow loam. The subsoil, a firm but friable sandy clay loam, grades from yellow to reddish yellow. Limestone or shale bedrock is at depths of 1½ to 10 feet, but on the lower part of the slopes

outcrops of shale or limestone residuum or of the bedrock itself are not uncommon.

Areas over shale are low in fertility and organic matter; those over limestone are of moderate fertility. The reaction is medium to strongly acid. The plow layer has good tilth and moisture infiltration and moderately high water-holding capacity. A few cobbles occur in places, but do not interfere with cultivation.

This phase is associated with Waynesboro, Nolichucky, and Holston soils, mostly in the Waynesboro-Nolichucky-Dunmore soil association.

Use suitability and management.—All of the soil was cleared at one time, and much of it is now used for corn, small grains, hay, tobacco, and pasture. No definite rotation is followed. Some fields are cultivated for a period of years, allowed to lie idle for several years, and again cultivated. Erosion is active in many areas now cropped.

This soil is suitable for crops, but its strong slopes require use of moderately long crop rotations. Substantial supplies of fertilizer, lime, and organic matter are necessary to improve productivity. Where adequately limed and fertilized, especially with phosphorus, fairly good legume-and-grass pasture can be maintained. For a discussion of use and management, see group 11 in the section on Use and Management of Soils.

Nolichucky clay loam, severely eroded rolling phase (5–12% slopes) (NB).—This phase has been eroded; practically all of the surface soil and, in places, part of the subsoil have been lost. The plow layer consists of reddish-yellow or strong-brown firm but friable sandy clay loam. It grades to variegated or mottled material at about 18 inches. Shale or limestone bedrock is usually at depths of 1½ to 10 feet. Some small gullies occur but they usually can be obliterated by tillage or grading. Most of the acreage occurs in small areas in the Waynesboro-Nolichucky-Dunmore and Holston-Nolichucky-Dandridge soil associations.

The soil is low in fertility and organic matter and medium to strongly acid. Tilth is poor. The soil is cloddy when dry and somewhat plastic when wet. Moisture penetrates more slowly than in the uneroded Nolichucky areas, and the water-holding capacity is low. Droughtiness develops quickly during dry periods.

Use suitability and management.—All of the soil has been cleared but parts have reverted to brush or pine forest. A small part is cultivated, and the largest acreage is used as unimproved pasture. Crop yields and quality of the pasture growth are low. Fertilizer is used for row crops and small grains, and some of the areas have been limed.

This soil is considered suitable for crops, but its moderately strong slopes, unfavorable tilth, low water-holding capacity, and low fertility limit its use. Runoff is an erosion hazard. Heavy fertilization and long rotations are required to improve productivity. It is likely that much of the phase could be used for permanent grass-and-legume pasture. For further discussion of management refer to group 9 in the section on Use and Management of Soils.

Nolichucky clay loam, severely eroded hilly phase (12–25% slopes) (NA).—This soil has been eroded so much that the 5- or 6-inch plow layer now consists almost wholly of subsoil material, or reddish-yellow firm but friable sandy clay loam. Below about 15 inches is

brittle sandy clay or sandy clay loam variegated or mottled with yellow, reddish yellow, and gray. Shale or limestone bedrock is usually at depths of 1 to 8 feet. Like the other Nolichucky soils, this soil consists of old alluvium. Most of this phase occurs in small areas closely associated with areas of other hilly Nolichucky soils. It is on slopes below the smooth ridge tops occupied by undulating and rolling Nolichucky and Waynesboro soils in the Waynesboro-Nolichucky-Dunmore and Holston-Nolichucky-Dandridge soil associations. Many areas have small gullies that can be obliterated by tillage or a little grading.

Use suitability and management.—All of this soil was cleared and cropped at one time. A small part is now cropped, a small area is pastured, and a considerable acreage is either idle or revegetating with pine forest. Because of the strong slope, unfavorable tilth, limited moisture-holding capacity, and low fertility, this soil is poorly suited to crops. With adequate fertilization, most of the acreage could support a good grass-and-legume cover. For further discussion, see group 15 in the section on Use and Management of Soils.

Nolichucky cobbly loam, rolling phase (5–12% slopes) (NF).—This soil differs from Nolichucky loam, undulating phase, chiefly in containing cobbles that interfere with cultivation. Small areas on the ridge tops may have slopes of 2 to 5 percent. Like the other Nolichucky soils, this one consists of old alluvium on high stream terraces. The 9-inch surface layer is very pale-brown cobbly loam. It is underlain by yellow to pale-yellow cobbly loam that extends to 15 inches. From this depth to 36 inches the material is reddish-yellow or strong-brown firm but friable sandy clay loam. Below 36 inches begins brittle sandy clay or sandy clay loam, variegated or mottled with yellow, reddish-yellow, and gray, that may contain cobbles and gravel. Limestone or shale bedrock is at depths of 2½ to 10 feet.

The soil is moderate to low in fertility, somewhat low in organic matter, and medium to strongly acid. Internal drainage and water-holding capacity are moderate. Areas are small and are associated with areas of Nolichucky and Waynesboro soils in the Waynesboro-Nolichucky-Dunmore and Holston-Nolichucky-Dandridge soil associations.

Use suitability and management.—Most of this rolling phase is in cut-over deciduous forest. It is suited to a wide variety of crops but the cobbles interfere with mowing, harvesting, and other field operations. Erosion is a hazard, but where the fertility is maintained and runoff is controlled, the soil can be used in a moderately long rotation without deterioration. See group 8 in the section on Use and Management of Soils for more detailed information on management.

Nolichucky cobbly loam, eroded rolling phase (5–12% slopes) (ND).—Because of erosion, this soil in most places has a plow layer that consists of a mixture of original surface and subsoil material. The 5-inch surface layer, a pale-brown or brownish-yellow cobbly loam, grades to reddish-yellow or strong-brown firm but friable cobbly sandy clay loam. A few small gullies occur in places, but most of them can be obliterated by tillage or grading.

Natural fertility and organic-matter content are moderate to low, and reaction is medium to strongly acid. Tilth is fairly good. Moisture infiltration and water-holding capacity are moderate. The more

fertile areas occur over limestone. Runoff is a hazard in cultivated areas. Bodies of this phase are associated with areas of Waynesboro soils and other Nolichucky soils in the Waynesboro-Nolichucky-Dunmore and Holston-Nolichucky-Dandridge associations.

Use suitability and management.—Most of this soil is cropped, chiefly to corn, small grains, hay, and tobacco. Corn and small grains are moderately fertilized, and yields are moderate. A small area is used for pasture, which is of fair quality.

Cobblestones are numerous enough to interfere with cutivation; otherwise this soil is suitable for a wide variety of crops. It is well suited to corn, tobacco, truck, and other row crops. Care is required to restrain runoff in cultivated areas. Fairly good grass-and-legume pasture can be maintained with adequate fertilization and proper seeding. For a discussion of use and management, see group 8 in the section on Use and Management of Soils.

Nolichucky cobbly loam, hilly phase (12–25% slopes) (NE).—This soil consists of old alluvium on high stream terraces. Much of it is associated with Waynesboro and other Nolichucky soils in the Waynesboro-Nolichucky-Dunmore and Holston-Nolichucky-Dandridge soil associations. It occupies slopes below the smoother Waynesboro and Nolichucky soils.

The soil contains cobbles that interfere with cultivation. Its fertility and organic-matter content are moderate to low, and its reaction is medium to strongly acid. Internal drainage and moisture infiltration are moderate and water-holding capacity is moderately high.

Use suitability and management.—Practically all of this soil is in cut-over deciduous forest. Because of its cobbly nature and strong slope, it is poorly suited to tilled crops. If it is required for cultivation, it can be used in long rotations that consist chiefly of close-growing crops. Properly fertilized, limed, and seeded, it is capable of supporting good pasture. For further discussion see group 14 in the section on Use and Management of Soils.

Nolichucky cobbly loam, eroded hilly phase (12–25% slopes) (NC).—As a result of erosion, the plow layer of this phase is a mixture of original surface soil and subsoil material. The 5- or 6-inch surface layer, a pale-brown or brownish-yellow cobbly loam, grades to reddish-yellow firm but friable cobbly sandy clay loam. Limestone or shale bedrock is usually at depths of 1½ to 10 feet, but residuum from shale or limestone or the bedrock itself commonly outcrops on the lower parts of some slopes. There are small exposed areas where practically all of the original surface soil has been eroded away and the plow layer consists of reddish-yellow firm but friable sandy clay loam.

This soil is moderate to low in fertility and organic matter and medium to strongly acid. Moisture infiltrates fairly well, but runoff develops more rapidly than on the uneroded forested soils. Water-holding capacity is moderate except on the more eroded areas, which have poor tilth and are droughty. The soil occurs on the stronger slopes in the Waynesboro-Nolichucky-Dunmore and Holston-Nolichucky-Dandridge soil associations.

Use suitability and management.—All of this eroded hilly phase was cleared and cropped at one time. Some of it is now used for corn, small grains, and hay but much is in unimproved pasture or lies idle. Yields normally are not high, and most pasture is of mod-

erate to low quality. Because of the strong slope and abundance of cobbles, this soil is poorly suited to cultivated crops. It can be cropped if necessary, although it is difficult to work and great care is necessary to maintain productivity and to restrain runoff. Where substantial fertilization and liming and proper seeding have been done, good quality legume-and-grass pasture can be maintained. Management of this soil is further discussed in group 14 in the section on Use and Management of Soils.

Ooltewah silt loam (0–2% slopes) (OA).—This light-brown imperfectly drained soil consists of alluvium deposited in limestone sinks. It is associated with the Dunmore soils in the Dunmore-Greendale soil association. The small separate areas, many of them less than 2 acres, are widely distributed over that part of the county underlain by limestone. The surface is nearly level or saucerlike; some areas are temporarily flooded because they have no surface outlets or drainways. All excess water moves away through underground channels.

Profile description:

0 to 18 inches, very pale-brown or grayish-brown mellow silt loam.
18 to 36 inches, mottled gray, yellow, and brown friable silt loam or silty clay loam; material below 36 inches may be grayer; limestone bedrock is usually at 8 to 20 feet.

A few small areas included with this soil are poorly or very poorly drained; they have a gray silt loam surface layer underlain at depths of 10 to 15 inches by gray, mottled with yellow, firm silty clay loam. In places the gray sublayer may be silty clay. These poorly drained areas are shown on the soil map by wet-spot symbol.

Ooltewah silt loam is one of the more fertile soils of the county. Organic-matter content is moderate and in places may be moderately high. The reaction ranges from slightly to medium acid. The plow layer has good tilth. The soil is permeable but internal drainage is retarded by slow removal of excess water through underground outlets. The high water-holding capacity and retarded internal drainage give the soil a relatively abundant supply of moisture during drier parts of the year.

Use suitability and management.—Practically all of Ooltewah silt loam has been cleared. Corn occupies probably one-third of the acreage. Small grains, tobacco, and alfalfa are not commonly grown, although some tobacco may be planted on the better drained areas. Some areas are used for permanent pasture. Because of high fertility, favorable tilth, and abundant supply of available moisture, this soil is well suited to corn, sorghums, soybeans, red clover, lespedeza, and most pasture legumes and grasses. Where acreage well suited to row crops is needed, such as on farms predominantly not suited to crops, the areas of Ooltewah soil can be used almost continuously for row crops if fertility is maintained. Fertilizer requirements, compared to those for some other soils, are not high. For further discussion, see group 3 in the section on Use and Management of Soils.

Prader silt loam (0–2% slopes) (PA).—This gray very poorly drained soil on bottom lands consists of alluvium that came largely from shale and slate. Most areas are in gentle depressions and are the first to be covered by floodwaters. The separate areas are few and small and occur chiefly in the Congaree-State and Staser-Sequatchie soil association.

Profile description:

0 to 8 inches, gray to light-gray mellow silt loam.
8 to 20 inches, gray, mottled with yellow and dark-brown, firm silt loam or silty clay loam.
20 inches +, gray firm compact plastic clay with some yellow and dark-brown mottlings; shale bedrock at depths of 4 to 10 feet.

In some places the plastic clay is within 10 inches of the surface, and in others the soil may be a relatively friable permeable silty clay loam to a depth of 3 feet. In places the surface layer is very mottled.

Natural fertility is low, and there is little organic matter in the surface layer. The reaction is slightly to medium acid. The upper part of the soil is permeable, but the slowly permeable clay layer greatly interferes with root development and moisture percolation. The water table is at or within a few inches of the surface much of the time, so the soil dries out slowly. This causes considerable delay in field work following rains. The tilth of the plow layer is moderate but varies according to the quantity of clay contained. Floods during the growing season damage crops and sometimes deposit mud on pasture foliage.

Use suitability and management.—Low fertility, excessive moisture, and susceptibility to flooding make this soil poor for crops. It will produce pasture, especially if drainage is improved and fertilizer is applied at seeding time. For a discussion of use and management, refer to group 18 in the section on Use and Management of Soils.

Ramsey shaly silt loam, steep phase (25–60% slopes) (RD).—This light-brown shallow soil on long steep ridge slopes is derived chiefly from slate. It is very extensive in the Ramsey (silt loam)-Hamblen soil association. Large bodies occur in association with extensive areas of other phases of Ramsey shaly silt loam and with relatively small areas of Hayter, Barbourville, and Hamblen soils.

Profile description:

0 to 3 inches, pale-brown to dark grayish-brown loose shaly silt loam; contains considerable organic matter in the upper 1 or 1½ inches.
3 to 10 inches, very pale-brown to brownish-yellow friable shaly silty clay loam.
10 to 24 inches, partly weathered slate and brownish-yellow friable silty clay loam; slate bedrock usually at depths of 6 to 24 inches; much of the slate appears shaly and is softer than typical slate fragments.

Slate bedrock is generally at 20 inches, but it is much shallower in some places and sometimes outcrops. A notable quantity of sand is in the soil in some places, although the texture in practically all places is at least a heavy loam.

The soil has moderate natural fertility and is medium acid. Water readily percolates through the soil, and is absorbed fairly rapidly by the underlying slate beds. Available moisture is limited. In general, moisture relations are more favorable on the north-facing than on the south-facing slopes. Tilth of the plow layer is good, but the shale interferes with tillage. Shale bedrock in many places is easily disrupted by heavy tillage implements.

Use suitability and management.—Practically all of this soil is in cut-over deciduous forest. Chiefly because of strong slope and shallow depth to slate beds, it is not suited to tilled crops. Good pasture could be produced, but its carrying capacity is limited, especially on the south-facing slopes. The acreage in forest is probably best kept

for that use. See group 17 in the section on Use and Management of Soils for further suggestions on management.

Ramsey shaly silt loam, eroded steep phase (25–60% slopes) (RB).—Much of the original surface layer has been lost from this phase, so it is more slaty and shallower to bedrock than the steep phase of Ramsey shaly silt loam. In places much of the soil material has been removed, and there are shallow gullies. Areas are large and occur in association with areas of other Ramsey shaly silt loam soils in the Ramsey (silt loam)–Hamblen soil association. Many areas are on slopes adjacent to Hamblen, Barbourville, and Hayter soils of the stream valleys.

Natural fertility and moisture-holding capacity are less favorable than for the uneroded steep phase. Runoff develops more quickly, and a good grass cover is more difficult to maintain—especially where erosion has brought the underlying slate beds within a few inches of the surface. Tillage is difficult, as the plow layer in most places contains a great quantity of slate.

Use suitability and management.—All of this soil was cleared and cropped at one time. Much is now used for unimproved pasture, some of the most eroded areas are idle, and a very small part is in crops (chiefly corn). Yields are low and little fertilization is practiced.

Because of shallowness to slate, low fertility, and steep slopes, the soil is poorly suited to tilled crops. It will support good pasture if the fertility is brought to at least a moderate level and proper seeding is carried out. The shortage of moisture during drier parts of the season greatly limits the carrying capacity of pasture. Moisture conditions are most favorable on the north-facing slopes, which provide fairly good grazing where the soil material is deepest. See group 17 in the section on Use and Management of Soils for information on management of this soil.

Ramsey shaly silt loam, very steep phase (60+% slopes) (RE).—Steep slope is the chief difference between this soil and the steep phase of Ramsey shaly silt loam. The depth to slate bedrock is less, and outcrops are common. The 4-inch surface layer is pale-brown to dark grayish-brown loose shaly silt loam; the underlying material is partly weathered slate and brownish-yellow friable silty clay loam. The soil is medium acid and of moderate natural fertility. It absorbs moisture fairly well but its capacity for holding it available to plants is low. Large bodies occur throughout the Ramsey (silt loam)–Hamblen soil association.

Use suitability and management.—Practically all of this soil is in cut-over deciduous forest. Because of its very strong slope and shallowness to slate, it is poorly suited to either crops or pasture. Its present use as forest land is recommended. For further discussion, refer to group 19 in the section on Use and Management of Soils.

Ramsey shaly silt loam, hilly phase (12–25% slopes) (RC).—This light-brown excessively drained soil is shallow to slate bedrock. In general, the brown surface layer is thicker, and the depth to slate bedrock is somewhat greater. The 4- or 5-inch surface soil is pale-brown to dark grayish-brown loose shaly silt loam. Below this and continuing to about 12 inches is a very pale-brown to brownish-yellow friable shaly silty clay loam. The underlying material is partly weathered

slate and brownish-yellow friable silty clay loam. Slate bedrock is at depths of 12 to 30 inches.

Natural fertility and content of organic matter are moderate in the surface layer; reaction is about medium acid. The soil is permeable, and the underlying slate is fairly permeable to water. Water-holding capacity, however, is low. In general, moisture conditions are more favorable for crops on the north-facing than on the south-facing slopes. Tilth is good, but slate fragments throughout the soil interfere with tillage.

Use suitability and management.—Practically all of this hilly phase is in cut-over deciduous forest, with some pine intermixed. Because of shallowness to slaty material and the strong slope, this soil is poorly suited to crops requiring tillage. Where its fertility is improved and maintained, it is capable of supporting good quality grazing, especially on the north-facing slopes. Long rotations of close-growing small grains and hay crops are recommended. This phase is discussed under group 17 in the section on Use and Management of Soils.

Ramsey shaly silt loam, eroded hilly phase (12–25% slopes) (RA).—This phase differs from the hilly phase chiefly in degree of erosion. In some places only the surface layer has been lost, but in others much subsoil material also has been removed. The most severely eroded areas have many gullies and much exposed slate bedrock. The total acreage of such eroded areas, however, is small. On most places the soil material extending all the way to slate bedrock is brownish-yellow or light-brown shaly silt loam or shaly silty clay loam. The soil is widely distributed in the Ramsey (silt loam)-Hamblen soil association. The separate tracts are smaller than those of the steep phases of Ramsey soils. Many of them occupy the narrow ridge crests above steeper Ramsey soils.

Organic-matter content is low, natural fertility is moderate, and reaction is medium acid. The soil is permeable. Available moisture for plants is low, though greater than for the steep phase. Tilth is good, but shaly fragments and slope interfere with tillage.

Use suitability and management.—Most of this soil was cleared and cropped at one time. At present, however, much of it is either idle or used as unimproved pasture. The limited crop acreage is used chiefly for corn, and yields are low. Crops are poorly suited because of the shallow depth to bedrock and the strong slope. Where fertility is improved the soil supports grazing. The carrying capacity varies according to depth of the soil material and exposure. The north-facing slopes have better moisture relations and are more productive than the south-facing slopes. The difference in carrying capacity, however, is not so great as on the steep phase. For a discussion of use and management, see group 17 in the section on Use and Management of Soils.

Ramsey stony fine sandy loam, steep phase (25–60% slopes) (RH).—This light-colored stony sandy soil is shallow to quartzite or conglomerate bedrock. It occupies large areas in the Ramsey (sandy)-Stony land soil association, which includes much of English, Meadow Creek, Stone, and Rich Butt Mountains. Most of it occurs at a lower elevation than adjacent areas of Rough mountainous land (Ramsey soil material).

Profile description:

0 to 8 inches, very pale-brown or light yellowish-brown loose stony fine sandy loam.
8 to 18 inches, brownish-yellow or pale-yellow friable stony fine sandy loam or sandy clay loam underlain by a matrix of pale-yellow sand material and partly disintegrated sandstone, quartzite, and conglomerate fragments; bedrock of quartzite, sandstone, or conglomerate usually at depths of 6 to 36 inches but sometimes outcropping.

Natural fertility and organic-matter content are very low, and the reaction is strongly acid. The soil material is permeable, but available moisture is low. The soil is too stony to cultivate—some of the rock fragments are more than 10 inches in diameter.

Use suitability and management.—Practically all of this soil is in cut-over forest, chiefly hardwoods with some pine intermixed. Because of the shallowness to bedrock, low fertility, high content of rock fragments, and steep slope, it is very poorly suited to crops and poorly suited to pasture. Its practical use is limited to forest. For further discussion, refer to group 19 in the section on Use and Management of Soils.

Ramsey stony fine sandy loam, eroded steep phase (25–60% slopes) (RF).—This phase has lost much soil material through erosion. The surface layer is yellowish-gray or brownish-yellow friable stony fine sandy loam. Under it is a matrix of pale-yellow sandy material and partly disintegrated sandstone, quartzite, or conglomerate fragments. Bedrock, at depths of 6 to 30 inches in most places, crops out in some areas. The rock fragments range up to 10 or 12 inches in diameter. The small areas are associated with areas of the steep phase of Ramsey stony fine sandy loam. Most of them are adjacent to soils better suited to tillage.

This soil is low in plant nutrients and organic matter and strongly acid. It is permeable, but available moisture is low because of shallowness to bedrock and sandy texture. Tillage is made difficult by stone fragments and strong slopes.

Use suitability and management.—All of this soil was cleared and cropped at one time, but much of it now is either idle or in unimproved pasture. A very small acreage is cultivated, chiefly to corn. Yields of both corn and pasture are low. Little fertilization is practiced. Because of the strong slopes, shallowness to bedrock, low fertility, and abundance of stone fragments, this soil is very poorly suited to crops and poorly suited to pasture. Its suitability is limited to forest. See group 19 in the section on Use and Management of Soils for further information.

Ramsey stony fine sandy loam, hilly phase (12–25% slopes) (RG).—Slope is the principal difference between this soil and the steep phase, though this phase also may have a somewhat thicker surface layer and greater depth to bedrock in its smoother areas. Where cleared and cultivated, the surface soil is 8 to 10 inches of very pale-brown or light yellowish-brown loose stony fine sandy loam. Below this and continuing to about 20 inches is brownish-yellow or pale-yellow friable stony fine sandy loam or sandy clay loam. Underlying this is a matrix of pale-yellow sandy material and partly disintegrated sandstone, quartzite, and conglomerate fragments. Bedrock is at depths of 12 to 36 inches. The separate areas are small and

occupy narrow ridge tops above the steep phases of Ramsey stony fine sandy loam. There are a few rock outcrops.

A small acreage of this soil was eroded following clearing and cropping. Here, the plow layer is brownish-yellow friable stony fine sandy loam. A few shallow gullies occur in places.

Use suitability and management.—Most of this hilly phase is in cut-over native forest. The small part that was cleared is now used chiefly as unimproved pasture or lies idle. The small cultivated acreage is used chiefly for corn. Little fertilization is practiced and yields are low.

The low fertility, low water-holding capacity, and high stone content make this soil poor for crops requiring tillage. Small parts may be suitable for crops that are to be cultivated with light or hand implements. Yields cannot be expected to be high, because fertility and available moisture are low. Much of the acreage, however, can produce a fair quantity of pasture providing it is adequately limed, fertilized, and properly seeded. The acreage not required for pasture is best suited to forest. For a discussion of use and management, see group 16 in the section on Use and Management of Soils.

Riverwash (1–5% slopes) (Rk).—This land type consists of very sandy, gravelly, or cobbly fresh alluvial deposits along some of the large streams, chiefly the French Broad River. The material contains little clay or silt, is extremely porous, and is low in plant nutrients. The surface is very gently undulating or billowy. Most areas are small and occur as narrow strips adjacent to the stream channel. They are only a few feet above normal stream flow and are the first areas on the bottom lands to be covered by floodwaters. This land type is altered each time a flood occurs.

Use suitability and management.—Riverwash has no value for crops or pasture and little value for forest. Some areas have a brushy growth of willow and other softwood trees of little commercial value. Group 19 of the section on Use and Management of Soils includes this land type.

Rock land (limestone) (5–40+% slopes) (Rl).—This land type consists chiefly of outcrops and loose fragments of limestone. Some silty clay or clay limestone residuum is in the interstices, but not enough to support either crops or pasture. A few areas have precipitous slopes because large streams have cut their valleys though limestone. The acreage is practically all in the Dunmore-Greendale soil association. Most of the separate areas are small and occur adjacent to rolling and hilly areas of the Dunmore soils and stony land types containing Dunmore soil material.

Use suitability and management.—This land type supports a sparse forest growth. Cedars predominate but there are some scrubby oaks. The land has little or no value for crops or pasture. Refer to group 19 in this section on Use and Management of Soils for further information on management of this land type.

Rough mountainous land (Ramsey soil material) (12–60+% slopes) (Rm).—Loose fragments and outcrops of quartzite, conglomerate, and sandstone, with a small quantity of intermixed soil material, compose this land type. The soil material consists chiefly of very pale-brown or light yellowish-brown fine sandy loam with which

stone fragments of variable sizes are intermixed. The depth to bedrock ranges up to about 18 inches, but in some areas there is practically no soil and the rock is at the surface. Large areas occur on English, Meadow Creek, and Stone Mountains and on high ridge tops.

Use suitability and management.—Practically all of this land type is in cut-over deciduous forest. It has no value for crops, and even the better parts are very poor for pasture. It produces some forest, but growth is slow and the yield is small. Access to much of the acreage is difficult. For a discussion of use and management, see group 19 in the section on Use and Management of Soils.

Sequatchie fine sandy loam (1–5% slopes) (SB).—This soil, like others of its series, occurs on sandy low stream terraces or benches. The parent material came chiefly from quartzite and sandstone, though it includes the sandy component from other rocks. The soil is brown, permeable, and well drained. Moderately large areas occur along the larger creeks, chiefly Cosby Creek, in the Congaree-State and Staser-Sequatchie soil association.

Profile description:

0 to 14 inches, dark to very dark grayish-brown loose fine sandy loam that grades with depth to firmer material.
14 to 36 inches, yellowish-brown friable loam.
36 inches +, light yellowish-brown coarse sand and gravel; bedrock usually at depths of 5 to 10 feet.

The surface layer in places approaches pale yellow. The texture varies from sandy loam to loamy fine sand, and some gravel and cobblestones occur along the creeks. A very few areas have a loam surface soil.

This is a moderately fertile soil. Organic-matter content is fairly low, and the reaction is medium acid. Tilth is exceptionally good, and the soil is well drained and permeable. Available moisture varies. The finer textured areas maintain a good moisture supply throughout most of the growing season, especially for such deep-rooted crops as corn, red clover, and alfalfa. The coarsest textured areas have a more limited supply of moisture.

Use suitability and management.—Practically all of this soil is cropped. About 40 percent is used for corn and tobacco, 25 percent for small grains, and 30 percent for hay. Some fields are used for row crops many years in succession. Some fertilizer is used, and tobacco receives heavy applications. Lime has been applied to much of the acreage.

This soil is well suited to intensive use, as it responds to fertilization and is easily worked and conserved. It warms early in spring and can be worked under a wide range of moisture content. A variety of crops can be grown, including many truck crops, tobacco, and alfalfa. The more sandy areas are less well suited to grass-and-legume sod crops than the more silty fertile soils. For further information on Sequatchie fine sandy loam, see group 4 in the section on Use and Management of Soils.

Sequatchie cobbly fine sandy loam (1–5% slopes) (SA).—This soil differs from the Sequatchie fine sandy loam chiefly in having gravel and cobblestones in quantities that interfere with cultivation. Some areas are so cobbly that their cultivation is impractical. The textures of the surface layer and subsoil are coarser than those of Sequatchie fine sandy loam. The soil is permeable, low in fertility, and more

droughty than the fine sandy loam. It occurs on low benches or terraces along the larger creeks, chiefly Cosby Creek, in the Staser-Sequatchie soil association.

Use suitability and management.—Practically all of the acreage was cleared and cropped at one time. A considerable part now is idle or used for permanent pasture. Corn is the chief crop, and some tobacco and hay are grown. Yields are high only in the more favorable well-managed and fertilized areas.

The less stony areas are suited to intensive use for row crops, but the difficulty of cultivation and other field operations greatly limits their value. The more stony areas are best for pasture. Grasses are not especially productive, except on the limited acreage where moisture supplies are better. See group 8 in the section on Use and Management of Soils for further information on management.

Staser fine sandy loam (0–2% slopes) (Sd).—This light-brown well-drained sandy soil occupies bottom lands along creeks; it consists of alluvium originating chiefly from sandy rocks—quartzite, sandstone, and conglomerate. Areas occur as narrow strips along the creeks in the Staser-Sequatchie soil association. Practically all of the soil is subject to flooding, and in most places it is less than 8 feet above normal stream flow.

Profile description:

0 to 10 inches, light yellowish-brown to brown fine sandy loam.
10 to 30 inches, light yellowish-brown to yellowish-brown fine sandy loam, a little lighter colored than the surface layer.
30 inches +, light yellowish-brown gravelly sandy loam; shale or slate bedrock usually at depths of 3 to 10 feet.

Gravel and cobblestones occur in many places, but ordinarily do not interfere with cultivation. Gravel beds may occur at a depth of 24 inches.

Natural fertility and organic-matter content are moderate, and sediments from overflow tend to maintain productivity. The reaction is medium to strongly acid. The soil is permeable, and moisture relations favorable for crops prevail throughout most of the growing season. Tilth is good, and drainage is adequate for all crops.

Use suitability and management.—Much of this soil is used intensively for row crops. Probably half the acreage is in corn and tobacco, a third in hay and pasture, and a small part in small grains and truck crops. It is especially valued for row crops, as most of it occurs where land suited to intensive use is scarce. Its smooth surface, permeability, and response to fertilization make it well suited to intensive use. Corn, tobacco, truck crops, and, in places, alfalfa are adapted, as well as most hay crops and small grains. Susceptibility to flooding is a hazard to all crops, especially high-value crops. For a discussion of management, refer to group 1 in the section on Use and Management of Soils.

Staser cobbly fine sandy loam (0–2% slopes) (Sc).—Gravel and cobblestones sufficient to interfere with cultivation distinguish this soil from Staser fine sandy loam. The 10-inch surface layer is light yellowish-brown to brown gravelly or cobbly fine sandy loam. It is underlain by slightly lighter brown gravelly or cobbly fine sandy loam. More gravelly material occurs at a depth of 24 inches.

In many places there is more gravel than soil material and tillage is extremely difficult. Most areas are less than 8 feet above normal stream flow and are subject to overflow. Natural fertility and organic-matter content are not high, and the reaction is medium to strongly acid. Internal drainage is excessive. The higher lying areas are droughty for shallow-rooted crops. Most of the acreage occurs along Trail Fork Big Creek south of Del Rio.

Use suitability and management.—A great part has been cleared and is used for crops, chiefly corn and hay. The most gravelly areas are idle part of the time. Intensive use of this soil is possible because of its smooth surface and permeability, but its stone content limits its use for row crops. It is suited to pasture but is droughty for the shallow-rooted pasture crops. The more desirable legumes and grasses are not so easily maintained as on the less sandy soils. Group 1 in the section on Use and Management of Soils includes this Staser soil.

Staser silt loam (0–2% slopes) (Se).—This is a brown well-drained soil on bottom lands. It consists of alluvium derived chiefly from calcareous shale. Most areas occur along creeks in the Dandridge-Leadvale-Hamblen and Steep Dandridge-Whitesburg-Hamblen soil associations. Drainage is better than on Hamblen silt loam, but floods are a hazard.

Profile description:

0 to 30 inches, brown to yellowish-brown friable silt loam.
30 inches +, yellowish-brown friable silt loam with some gray and brown mottlings; bedrock usually at depths of 3 to 10 feet.

A dark-brown layer, an old, buried surface layer, occurs 10 to 20 inches below the surface in places. Below 20 inches the texture is silty clay loam in some areas. Locally, some shale fragments occur, and a shaly matrix may be at depths of 30 to 45 inches in places.

This fertile slightly to medium acid soil has a fair to moderate supply of organic matter in the upper 12 to 18 inches. It is permeable and has good tilth. Available moisture is relatively great, and moisture relations are generally favorable for plant growth.

Use suitability and management.—Practically all of Staser silt loam is used for crops or pasture. Corn and tobacco probably occupy 60 percent of the acreage, and pasture and hay most of the rest. A small acreage is in truck crops, such as potatoes. Crop yields are high.

This soil is well suited to intensive use because of its smooth surface, good tilth, favorable moisture relations, and moderately high fertility. Corn, red clover, orchard grass, timothy, and lespedeza are among the best suited crops. Tobacco yields are good, though some of the higher lying well-drained soils over limestone and on stream terraces are better for this crop. Beans, potatoes, and tomatoes are well suited. Soybeans, though not commonly grown, can be expected to do well. Permanent pasture is well suited, and some of the more desirable legumes and grasses yield well. The soil is especially valuable for midsummer grazing, when growth on many of the higher lying soils is often suppressed by dry conditions. Refer to group 1 in the section Use and Management of Soils for further discussion of management.

State loam (0–2% slopes) (Sf).—This brown well-drained soil on low stream terraces consists of alluvium originating from micaceous rocks—granite and gneiss. It is distinguished from Sequatchie soils by the mica content. It occupies low benches along the French Broad, Nolichucky, and Pigeon Rivers in the Congaree-State soil association. It occupies large areas on smooth valley floors, and much of it is well suited to crops. About 589 acres have been inundated by the Douglas Reservoir.

Profile description:

0 to 14 inches, dark grayish-brown loam.
14 to 40 inches, brown friable but somewhat firm loam that grades to yellowish-brown; texture becomes coarser with depth.
40 to 72 inches +, yellowish-brown, grading to brownish-yellow, loamy fine sand; bedrock is usually at depths of 5 to 10 feet.

Mica occurs throughout the soil, and some areas have cobblestones. This fertile soil contains a moderate quantity of organic matter in the surface layer. Its reaction is medium to strongly acid. Tilth is favorable, and the soil material is permeable and well drained. Except in most sandy areas, favorable moisture relations are maintained throughout much of the growing season. In general, State loam can be worked under a wide range of moisture conditions.

Use suitability and management.—Most of State loam is planted to corn, tobacco, and some truck crops. Small grains and hay are common (pl. 1, *C*) but less so than the row crops. Some areas are used intensively for row crops several years in succession.

As it is productive, easily worked and conserved, responsive to good management, and suitable for a wide variety of crops, this is one of the most desirable soils of the county for crops and pasture. Fertilization is commonly practiced, and much of the acreage has been limed. The more loamy areas are especially desirable for grazing in midsummer, as their moisture relations are then more favorable than for many of the soils of the uplands. See group 4 in the section on Use and Management of Soils for management of this loam.

Stony colluvium (Jefferson soil material) (5–30% slopes) (Sg).—This land type consists chiefly of colluvial material composed of quartzite and sandstone rock fragments with some intermixed soil material. The areas occur on sloping to strongly sloping foot slopes below mountainous areas of Ramsey soils. Stone fragments ranging up to 3 or 4 feet in diameter are numerous enough to make tillage impossible and the pasture value low. The small quantity of intermixed soil material is yellow or brownish-yellow sandy loam. Bedrock is at depths of 2 to 10 feet. The largest areas are at the base of the west slope of Neddy Mountain in the Jefferson-Allen-Barbourville soil association.

Use suitability and management.—Much of this land type is in native deciduous forest, its best use. This land type is included in group 16 in the section on Use and Managment of Soils.

Stony hilly land (Dunmore soil material) (12–25% slopes) (Sh).—Limestone outcrops and loose fragments are so abundant in areas of this land type that tillage is impractical (pl. 4, *A*). Rock probably occupies 10 to 50 percent of the surface. The soil material between the rocks is similar to that of the Dunmore or Dewey soils.

The surface layer varies from silt loam to silty clay loam and is grayish brown to brown. The underlying material is reddish-brown or red firm silty clay. The thickness of this material over bedrock ranges from 0 to 3 feet. Areas of this land are associated chiefly with the Dunmore soils in the Dunmore-Greendale soil association.

The soil material is relatively fertile and moderate in organic-matter content. The reaction is about medium acid. Tilth of the soil material varies; in some places it is friable and easily worked, but in others the content of clay is sufficiently high to make it somewhat intractable and difficult to till. Internal drainage and available moisture are good.

Use suitability and management.—Much of this land type has been cleared. Uncleared areas are now occupied chiefly by cedars and some deciduous hardwoods. The cleared acreage is used for permanent pasture. Except where erosion has been very active, bluegrass and white clover, with Bermuda grass and crabgrass in places, make up the chief grazing vegetation. Little land is used for crops.

Because of the large quantity of stone, this land type is poorly suited to crops requiring cultivation. Some relatively stone-free areas are sufficiently large to be cropped if hand tillage is used. Practically all areas are suitable for pasture and should produce forage of good quality and carrying capacity if fertilized, especially with phosphorus. Carrying capacity, however, cannot be expected to be so great as on soils having more available moisture, such as Lindside silt loam and Hamblen silt loam. For a discussion of use and management, see group 15 in the section on Use an Management of Soils.

Stony rough land (Ashe soil material) (30–60 +% slopes) (SK).—Steep to very steep areas with many outcrops of gneiss or granite rock make up this land type. There is some Ashe soil material but it usually occupies less than 50 percent of the area. Little or no soil material is on the steepest slopes. In places where a soil has started to develop, the surface 3 or 4 inches is grayish-brown loam underlain by very pale-brown to yellow loam or sandy loam. Bedrock is within 0 to 24 inches of the surface in these areas. This fairly extensive land type is in the southeastern part of the county. Most of it occurs in one large body along the North Carolina-Tennessee State line. It occurs on the highest mountain range in the area.

Use suitability and management.—Practically all areas are in decidous forest with some intermixed pines. Because of its extreme stoniness and strong slopes, this land is not suitable for either crops or pasture. See group 19 in the section on Use and Management of Soils for management of this land type.

Stony steep land (Dunmore soil material) (25–60% slopes) (SL).—This land type consists of areas in which limestone outcrops and loose rocks are so numerous that cultivation is impractical. The outcrops and loose stones occupy 25 to 60 percent of the surface. This land differs from Stony hilly land (Dunmore soil material), chiefly in stronger slope. In general, this steeper type is more stony and less deep to bedrock. What soil material there is has a moderate content of organic matter and is moderately fertile. Internal drainage is good. Tilth is only fair where the surface layer has a silty clay loam texture. In places, the texture is silty clay. The reaction is medium acid.

Available moisture is limited by the shallow depth to bedrock, and much of the land type is droughty. The acreage is widely distributed in the Dunmore-Greendale soil association.

Use suitability and management.—A part of this land type is used for pasture; the rest has an uneven cover of cedars and deciduous trees, chiefly oaks. Part of the cleared acreage affords some grazing, but many areas support only scant vegetation. Because of extreme stoniness this land is unsuitable for cultivated crops and only poor to fair for pasture. On the whole, most of it is best suited to forest. The less stony areas are suitable for grazing, especially where a good grass cover has developed. For further discussion of management see group 19 in the section on Use and Management of Soils.

Teas silt loam, steep phase (25–60 + % slopes) (Tc).—This is a shallow purplish soil underlain by purplish or reddish shale or shaly limestone. It occurs on the sides of Neddy and Piney Mountains, and its relief is predominantly steep and rugged.

Profile description:

0 to 6 inches, light reddish-brown friable silt loam that contains some shale fragments.

6 to 18 inches, light reddish-brown to reddish-brown firm shaly silty clay loam, grading to shaly silty clay with depth, and underlain by bedrock or partly weathered purplish shaly material.

Rock outcrops are common, and in places there are many rock fragments. Natural fertility is moderate. The reaction ranges from neutral to medium acid. The soil material is permeable, though the subsoil retards percolation somewhat. Tilth is good but stone fragments and outcrops interfere with tillage. Available moisture is limited.

Use suitability and management.—Practically all of this soil is in forest. It is very poorly suited to crops or pasture because of its shallowness, steep slopes, and stoniness. Refer to group 19 in the section on Use and Management of Soils for further information.

Teas silt loam, hilly phase (12–25% slopes) (Tb).—This phase differs from the steep phase of Teas silt loam chiefly in slope. Most of it occurs on ridge tops above steep Teas soils about 7 miles south of Newport. The 6-inch surface soil in forested areas is light reddish-brown or purplish-brown silt loam frequently containing rock fragments. Below this and continuing to depths of 18 to 20 inches the subsoil is reddish-brown or purplish-red silty clay loam. Purplish or pinkish shale or shaly limestone bedrock is at depths of ½ to 2 feet. In cleared and cultivated areas, the plow layer is more nearly a silty clay loam and the depth to bedrock is less. Shallow gullies and rock outcrops occur in both the cleared and uncleared areas.

Use suitability and management.—About two-thirds of this soil is in native forest. Much of the cleared area is used as unimproved pasture. The most severely eroded parts are idle, and very little land is cropped. Its shallowness to bedrock, hilliness, and poor accessibility make this soil poor for crops. If fertilized it is capable of producing some pasture. For further discussion of management, see group 17 in the section on Use and Management of Soils.

Teas shaly silty clay loam, eroded steep phase (25–60 + % slopes) (Ta).—This phase has been eroded and probably represents what is left of those parts of Teas silt loam, steep phase, that were less

stony and deeper to bedrock at the time of clearing. The surface soil now is reddish-brown silty clay loam underlain by the heavier clay part of the deep subsoil. Bedrock or partly disintegrated shaly limestone is at depths of 6 to 18 inches. Gullies are common in places, but most of them are shallow. Areas are associated with the uneroded steep Teas soils on slopes of Neddy and Piney Mountains.

Use suitability and management.—All of this soil was cleared and cropped at one time, but most of it is now used as unimproved pasture. The most severely eroded areas have a very poor grass cover. Because of the shallowness to bedrock and steep slopes, this soil is very poorly suited to crops and not very productive of pasture. Much of it is best used for forest production. The deeper, less steep areas are capable of producing some grazing if well managed and fertilized. For further discussion, refer to group 19 in the section on Use and Management of Soils.

Tusquitee silt loam, rolling phase (2–12% slopes) (TE).—The parent material of this dark-brown well-drained soil is alluvium and colluvium washed from soils developed from granite and gneiss. The soil is associated chiefly with the Ashe soils and Rough mountainous land (Ramsey soil material) in the southeastern part of the county. The Tusquitee soils have a higher position and consequently a somewhat cooler climate than soils in the valleys.

Profile description:

0 to 24 inches, brown to dark-brown mellow silt loam; silty clay loam texture in many places in the lower part.
24 to 36 inches, pale-brown or dark yellowish-brown firm but friable silty clay loam.

Granite or gneiss bedrock is at depths of 2 to 10 feet. Occasional rock outcrops and loose rock fragments occur but do not interfere much with cultivation. Natural fertility and organic-matter content are high. The reaction is medium to strongly acid. This soil is permeable and has favorable moisture relations much of the growing season. Its tilth is good.

Use suitability and management.—Much of this soil has been cleared and is now used for crops and pasture. Some areas are inaccessible. Corn and hay, the chief crops, are fed on the farms. High fertility and permeability make this soil suitable for a wide variety of crops. Certain truck crops and potatoes are better suited to its cool climate than to soils at lower elevations. It responds to fertilizer and can be used intensively, but the more sloping areas require great care to minimize erosion. It is capable of supporting good quality pasture of high carrying capacity if properly managed and fertilized. For further discussion, see group 3 in the section on Use and Management of Soils.

Tusquitee silt loam, hilly phase (12–25% slopes) (TD).—This phase differs from the rolling phase of Tusquitee silt loam chiefly in slope. In general, depth to bedrock is less, and there may be more rock outcrops. The soil material to a depth of about 15 inches is brown or dark-brown mellow silt loam. Below this depth the color is lighter and the texture is generally silty clay loam.

This fertile soil is moderately high in organic matter, well drained, permeable, and favorable in tilth. In places rock fragments interfere with cultivation. The soil absorbs moisture well, and its water-hold-

ing capacity is high. The areas are associated with the rolling phase of Tusquitee silt loam and the steep and very steep Ashe and Ramsey soils in the southeastern part of the county.

Use suitability and management.—Some areas are used for crops and pasture, but many of them are somewhat inaccessible so that disposing of crops is difficult. Cultivated crops are well suited, but they require careful management. Small grains and hay are suited, and in many places the soil would be best used for pasture. Refer to group 10 in the section on Use and Management of Soils for further information.

Tyler silt loam (0–2% slopes) (TF).—This gray very poorly drained soil on stream terraces consists of old alluvium largely derived from shale and slate. Intermixed is material from limestone, and in a few areas probably some from micaceous rocks. Most areas lie slightly below areas of the associated soils on the terraces in the Holston-Monongahela-Tyler soil association along the French Broad River, especially south of Bybee.

Profile description:

0 to 8 inches, white or light brownish-gray floury silt loam.
8 to 18 inches, white moderately friable silty clay loam with some yellow and brown mottlings.
18 inches +, gray very compact silty clay mottled with yellow; bedrock, usually shale, is at depths of 5 to 10 feet.

The compact layer is within 10 inches of the surface in places. There are also a few areas where the material from a depth of 6 to 16 inches is pale-yellow friable silty clay loam with a few mottlings and the compact layer is 18 or 20 inches below the surface.

This soil is very low in fertility and organic matter and medium to strongly acid. Tilth is good, but the soil is wet so much of the time that it is suitable for cultivation for only short periods. Water-holding capacity is fair, but moisture conditions in general are unfavorable. There is a great excess of moisture much of the time, yet during the driest periods a droughty condition prevails.

Use suitability and management.—Some areas of this soil are under native deciduous forest, but the greater part is cleared and in unimproved pasture. Some of the better drained areas are used for corn and hay. A little fertilization is practiced, and some lime has been applied. Yields are low and variable. Good yields are obtained during favorable seasons where good management is practiced. Productivity of crops such as corn, soybeans, and certain hay crops can be increased by artificial drainage where feasible, and by applying fertilizer and lime. With adequate fertilization, good permanent pasture can be established on the better drained parts. Artificial drainage as well as fertilization, is required for good pasture stands on areas with poorer drainage. Refer to group 18 in section Use and Management of Soils for further information on management.

Waynesboro loam, undulating phase (2–5% slopes) (WF).—This soil, like others of its series, has a brown surface layer and red firm sandy clay loam or sandy clay subsoil. It consists of old alluvium on high stream terraces. Much of the material is from shale, slate, and sandy rocks, and a smaller part from limestone. Most areas contain some mica originating from granite, gneiss, and schist in the mountainous areas to the east. The soil occupies the smoothest ridge

tops of the high stream terraces, mostly in the Waynesboro-Nolichucky-Dunmore soil association.

Profile description:

0 to 10 inches, grayish-brown or brown loam.
10 to 36 inches, yellowish-red, grading to red, firm but friable sandy clay loam or sandy clay.
36 inches +, red, firm, brittle sandy clay loam or sandy clay variegated or mottled with yellow and gray; bedrock, in most places limestone, is usually at depths of 5 to 15 feet.

Cobblestones occur in places. The few areas on which they interfere with cultivation are indicated on the map by symbol.

The surface layer of this moderately fertile soil contains some organic matter. The reaction is medium to strongly acid. Internal drainage is moderate, and water-holding capacity is fairly high. Tilth is good. Runoff does not develop rapidly.

Use suitability and management.—Much of this undulating phase is cultivated. Corn, small grains, hay, and tobacco are the chief crops, and yields are fairly high. Row crops are grown 2 or 3 years in succession. Fertilizer is commonly used; tobacco receives heavy applications and much of the available barnyard manure.

This soil is one of the more desirable for crops, as it is easily worked and conserved, responds well to good management, and is suited to a wide variety of crops—including tobacco, truck crops, and the more exacting legumes and grasses. Properly fertilized and seeded, it is capable of supporting good quality pasture of high carrying capacity. Group 4 in the section on Use and Management of Soils includes this soil.

Waynesboro loam, eroded rolling phase (5–12% slopes) (We).—Erosion and slope account for the principal differences between this soil and the undulating phase of Waynesboro loam. The plow layer in most places is a mixture of surface soil and subsoil material. The 5- or 6-inch surface layer is brown to reddish-brown loam; it is underlain by a yellowish-red or red firm but friable sandy clay loam or sandy clay subsoil. All of the surface soil has been removed in some areas. As a result the plow layer consists of reddish-yellow sandy clay loam. Areas containing cobblestones in numbers that interfere with cultivation are indicated by symbols on the soil map. Bedrock is usually at depths of 2½ to 12 feet. This is one of the more extensive soils of the Waynesboro-Nolichucky-Dunmore soil association well suited to crops.

Some areas, especially those on the gentle ridge tops, have a gradient of less than 5 percent. Natural fertility is moderate, and some organic matter is in the surface layer. The soil is medium to strongly acid. Internal drainage is moderate, and moisture infiltrates at a moderately rapid rate. Runoff accumulates on the stronger slopes and is erosive where the soil is not well protected by vegetation. Water-holding capacity is moderately high. Tilth is good except on the most severely eroded areas.

Use suitability and management.—This soil is desirable for general farm crops and pasture. All of it is cleared, and much is in corn, small grains, hay, and tobacco. Some fertilizer is used, and probably all fields have been limed. Yields are generally good. Runoff water is a hazard; consequently, moderately long rotations are required.

The soil responds to fertilization and is easily worked, but the slope interferes with field operations. When properly fertilized and seeded, good pasture of high carrying capacity can be maintained. For further discussion, see group 6 in the section on Use and Management of Soils.

Waynesboro loam, eroded hilly phase (12–25% slopes) (WD).—This phase differs from the undulating phase chiefly in slope. It is shallower to bedrock or rock residuum, and outcrops of these materials are common along the lower edges of the slopes on which this soil occurs. Most of the soil is in narrow strips on the escarpment slopes of the high stream terraces. All of it is in the Waynesboro-Nolichucky-Dunmore soil association.

The plow layer, a mixture of the original surface soil and subsoil, is predominatly brown or reddish-brown loam or clay loom. Below this is the firmer, yellowish-red or red sandy clay loam subsoil. The small area that has not been cultivated has an 8-inch grayish-brown or brown loam surface layer.

This moderately fertile soil contains some organic matter in the surface 6 or 8 inches. The reaction is medium to strongly acid. Internal drainage is moderate. Runoff develops fairly rapidly and is very erosive on cultivated areas. Water-holding capacity is moderate. The south-facing slopes are more droughty than slopes facing north.

Use suitability and management.—Although much of this soil has been cleared and cultivated at one time, many areas are now idle or in unimproved pasture. Some acreage is used for corn, small grains, and hay. Average yields are low. Corn and small grains are fertilized, but hay and pasture commonly are not. Lime has been applied to much of the soil, however, and some pasture is well managed and of high carrying capacity.

Workability and conservability are difficult because of the strong slope. Areas used as cropland require long rotations. With such a rotation, red clover, alfalfa, and most general farm crops are suited. High-value cash crops require intensive field operations and cultivation and are not well suited. If adequately fertilized and properly seeded, legume-and-grass pasture is well adapted. For a discussion of management, see group 10 in the section on Use and Management of Soils.

Waynesboro clay loam, severely eroded rolling phase (5–12% slopes) (WB).—This phase has been so eroded that the plow layer consists chiefly of subsoil material. The 10- to 14-inch surface layer is yellowish-red firm but brittle or friable sandy clay loam. Below this is a variegated red, yellow, and gray firm brittle sandy clay or sandy clay loam. Limestone bedrock is at depths of 1½ to 10 feet. Small gullies are common. Areas are small and occur in association with areas of other Waynesboro soils in the Waynesboro-Nolichucky-Dunmore soil association.

The soil is low in fertility and organic matter and medium to strongly acid. Its firm clay consistence gives it poor tilth; it is hard when dry and moderately plastic when wet. Moisture percolates slowly, and the soil is droughty because supplies of available moisture are low. The slow permeability and strong slope allow quick development of runoff and consequent erosion of cultivated areas.

Use suitability and management.—Unfavorable moisture relations and low fertility limit suitability. Properly managed, the soil is suited to long rotations made up of small grains and grass-and-legume hay or pasture. High yields cannot be expected, for available moisture is low. For further discussion, refer to group 9 in the section on Use and Management of Soils.

Waynesboro clay loam, severely eroded hilly phase (12–25% slopes) (WA).—The plow layer of this eroded soil consists entirely of subsoil material. The 18- or 20-inch surface layer is yellowish-red or red firm but friable sandy clay loam. The subsoil is a red sandy clay loam or sandy clay variegated or mottled with yellow and gray. Bedrock, in most places limestone, is at depths of 1 to 8 feet. The soil occurs as narrow strips on some of the escarpments of the high stream terraces. Most areas are in the Waynesboro-Nolichucky-Dunmore soil association.

A few gullies occur but most are shallow. This soil is moderately low in fertility, low in organic matter, and medium to strongly acid. Moisture infiltrates slowly and causes a large quantity of runoff—a great erosion hazard. Tilth is unfavorable. The soil is droughty because water-holding capacity is low.

Use suitability and management.—All of this soil was once cleared and cultivated, but much is now idle or in unimproved pasture. Parts have been reforested with pine, and very little is cropped. Pasture is usually of poor quality and low carrying capacity. Because of the strong slope, slow permeability, low water-holding capacity, and low fertility, this soil is poorly suited to crops. It will support pasture of moderate carrying capacity if fertility is increased and desirable legumes and grasses are seeded. In general, the north-facing slopes are more productive than the south-facing because they are less droughty. Group 15 in the section on Use and Management of Soils includes this phase.

Waynesboro cobbly loam, eroded hilly phase (12–25% slopes) (WC).—This phase differs from the eroded hilly phase of Waynesboro loam chiefly in containing cobbles that interfere with cultivation. The stones range from the pebble size to 8 or 10 inches in diameter. The plow layer, in most places a mixture of the original surface soil with subsoil, is brown or reddish-brown cobbly loam. Below this is the yellowish-red or red firm but friable sandy clay loam or sandy clay subsoil. Bedrock, limestone, in most places, is at depths of 1½ to 10 feet. The soil occurs in narrow strips on some of the escarpments of high stream terraces in the Waynesboro-Nolichucky-Dunmore soil association.

The shallower areas are on the more exposed slopes and along the lower edges. Occasional rock outcrops occur. Some areas have lost all of the original surface soil through erosion and now have a plow layer of yellowish-red firm but friable sandy clay loam. The original surface soil remains on a small acreage under native deciduous forest; it is a brown cobbly loam 5 to 8 inches thick.

This soil is moderately fertile, and its surface layer contains some organic matter where erosion is moderate. The reaction is medium to strongly acid. Internal drainage is moderate. Runoff develops during heavy rains and seriously erodes cultivated areas.

Use suitability and management.—Although this soil has good drainage and responds well to proper management, its strong slopes and content of cobblestones limit suitability for crops. A part is under deciduous forest, but most of it was cleared and cropped at one time. Much of it is now in pasture, and some of the most eroded acreage is idle. Areas needed for cultivation require long rotations, as well as liming and fertilization that will maintain a good cover of close-growing crops. Pasture of good quality and fairly high carrying capacity can be maintained where good management is practiced. See group 14 in the section on Use and Management of Soils for further information on this phase.

Wehadkee silt loam (0–2% slopes) (WG).—Alluvium that came from micaceous rocks is the parent material of this poorly drained soil on bottom lands. It is nearly level or depressed, usually occupies the lowest parts of the flood plains, and is among the first soils to be flooded. Most of the acreage occurs as narrow strips representing old stream channels of the French Broad, Nolichucky, and Pigeon Rivers in the Congaree-State and Staser-Sequatchie soil association. About 148 acres along the French Broad River was inundated by the Douglas Reservoir.

Profile description:

0 to 6 inches, light brownish-gray silt loam mottled with yellow and brown.
6 to 18 inches, mottled gray, yellow, and brown tight plastic silty clay.
18 to 36 inches +, predominantly gray tight silty clay to moderately friable sandy clay loam; some yellow and brown mottlings; bedrock usually at depths 4 to 15 feet or more.

In places the surface layer is dark grayish brown. Some areas have a moderately friable subsoil, and in a few places sandy lenses occur below 18 inches.

Fertility ranges from fair to moderately high, the dark areas being highest. The reaction is medium to strongly acid. Internal drainage is very slow. The water table is at or near the surface during the wetter seasons, but during the driest parts of the growing season many areas are too droughty for good plant growth. Tilth is poor to fair, and periods that permit cultivation are short.

Use suitability and management.—About 75 percent of the acreage is used for pasture, a small part is in hay and corn, and the rest is in deciduous forest. Pastures are only fair; they contain much weedy growth and correspondingly less of palatable grasses. Cultivated crops are poorly suited because of the prevailing wetness and susceptibility to flooding. Artificial drainage is the chief requirement for improving productivity of pasture and crops. Corn, sorghum, and soybeans are among the better suited crops for drained areas. Refer to group 18 in the section on Use and Management of Soils for further information on management.

Whitesburg silt loam (0–5% slopes) (WH).—Alluvium washed chiefly from Dandridge and Litz soils is the parent material of this imperfectly drained soil. Areas occur along the upper reaches of drainways and as gentle valley slopes at the foot of steeper Dandridge and Litz soils. They are widely distributed throughout the Dandridge-Leadvale-Hamblen and Steep Dandridge-Whitesburg-Hamblen soil associations.

Profile descriptions:

0 to 18 inches, brown or pale-brown silt loam.
18 to 30 inches, yellowish-brown friable silt loam or silty clay loam, moderately mottled with gray and brown.
30 inches +, mottled gray, yellow, and brown, firm silty clay loam; shale bedrock is usually at depths of 2 to 6 feet.

Some places have a darker brown layer at depths of 8 to 15 inches, and an older surface layer buried by recent overwash. Many fine shale fragments occur in some places but do not interfere much with cultivation.

Natural fertility is moderate, organic-matter content in most places is not high, and the reaction is slightly alkaline to medium acid. All areas have good tilth, though field operations in spring are delayed following rains. Small bodies near drainways are temporarily flooded during heavy rains, but runoff is rapid enough to avoid much damage to crops from prolonged submersion. During wetter parts of the year the water table is high in areas near drainage channels, but during the growing season excess soil moisture is not a deterrent to crop growth. Available moisture is high, and moisture conditions throughout a great part of the growing season are particularly favorable for corn, sorghum, soybeans, and many hay crops.

Use suitability and management.—Smooth surface, good tilth, favorable moisture relations, and good response to fertilization make this a very desirable soil. It is especially valuable in a landscape such as that of the Steep Dandridge-Whitesburg-Hamblen association, which consists mostly of soils poorly suited to cultivation. Most areas are used intensively for crops, chiefly corn. Other common and well-suited crops are red clover for hay, tobacco, small grains, and some truck crops. Fertilization is practiced, and heavy applications are given tobacco and truck crops. With proper fertilization, row crops can be grown many years in succession. Much of the soil is suitable for alfalfa and small grains, though some areas are so fertile that small grains lodge badly. This soil is particularly desirable for use as midsummer pasture to supplement pasture on the more droughty steeper shallow soils of the uplands. Favorable moisture relations extend the growth of pasture plants well into the drier part of the growing season, and the more desirable legumes and grasses are well suited. See group 3 in the section on Use and Management of Soils for management suggestions.

USE AND MANAGEMENT OF SOILS[8]

The more prosperous farmers of Cocke County are interested in using and managing their soils in such way that they can obtain highest practical yields year after year without depleting their soils. Many farmers in the county are now practicing good soil management and thereby obtaining yields much higher than the county average. In general, these farmers are following practices basic to good farming. They do these things:

[8] Soil *use* refers to broad farm uses; that is, for (1) crops requiring tillage, (2) permanent pasture, and (3) forest. Soil *management* refers to (1) choice and rotation of crops, (2) application of crop residues, manure, and lime and commercial fertilizer, (3) tillage practices, and (4) engineering practices for controlling water on the land.

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1. Use good crop varieties that are adapted to the county.
2. Use a suitable crop rotation that also makes best use of water on the land. Generally it is a rotation that includes (a) a legume for maintaining supplies of nitrogen, (b) a tilled crop for weed control, (c) a deep-rooted crop to reach nutrients in the subsoil and increase permeability, and (d) pasture, meadow, or a green-manure crop to furnish organic matter and improve tilth.
3. Return barnyard or green manure to the soil in order to maintain supplies of nitrogen and fresh organic matter.
4. Apply limestone, phosphate, nitrogen, potash, or any combination of these, in amounts to meet the needs shown by soil tests.
5. Take reasonable care in preparing seedbeds and follow the recommendations of the Agricultural Experiment Station for times and rates of seeding.
6. Control weeds, insects, and diseases.

These basic practices apply to all soils in the county, but not in the same relationships. Soils differ in their suitability for agricultural use and in the management they require. Weed control, for example, may be a primary problem on a fertile soil, but secondary on a soil depleted of nitrogen and organic matter. Insofar as the type of agriculture followed on a given farm will permit, the management practices should be fitted to the needs of the particular soils.

The need for adjusting management to local conditions prevents suggesting in this report combinations of management practices suitable for single farms. Nevertheless, it is possible to furnish general guides to good management by placing soils with about the same management needs in groups and suggesting suitable practices for each group. That has been done in this report. There are 19 groups, each discussed separately, in the subsection on Management Groups. The practices suggested for each group are guides for the farmer who wants to work out a set of management practices suited to his particular farm.

Before working out a plan for his farm, the farmer should supplement information in this report with that from other sources. Much information on soil and crop management can be obtained from bulletins and circulars prepared by the Tennessee Agricultural Experiment Station and the Tennessee Extension Service, Knoxville, Tenn., and by the United States Department of Agriculture.[6]

The county agricultural agent will be particularly helpful in arranging to have soils analyzed by the Soil Testing Division of the Tennessee Crop Improvement Association; in working out applications of phosphorus, potassium, and lime to meet needs shown by the soil tests; and in solving problems of management that apply to a specific farm.

MANAGEMENT GROUPS

The soils of this county have been placed in 19 management groups to facilitate discussion of their suitability for agriculture and the management practices they require. All the soils in any one group need about the same management, but it does not follow that response to suitable management will be the same for all soils in a given group. Some soils respond better to management than others.

[6] A list of U. S. Department of Agriculture publications can be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., and the publications purchased through him at nominal cost.

Use for permanent pasture, as well as for cultivated crops, was considered in making the management groupings. For most groups, the management requirements for pasture are similar to those for crops requiring tillage. Most soils of the county, however, need more exacting management when used for crops requiring tillage. In consequence, two or more management groups may have the same management requirements for pasture, but each group has differences in management requirements for tilled crops that distinguish it from other groups.

Estimated yields.—Accompanying the discussion of each management group is a table giving estimated average yields of principal crops and permanent pasture [7] to be expected under two levels of management. In column A of each of these tables are yields to be expected under the level of management used by most farmers in the county at the time of survey, and in column B are yields to be expected under better management. The better management is that level of management used by the more prosperous farmers in the county—a level considered economically feasible at the time of survey. The practices required for better management are equivalent to those recommended for each group under the subheading Management Requirements.

The tables of estimated yields are based on average expectable yields for approximately a 5-year period, so crops yields higher than those given may be obtained in favorable seasons. Yields larger than those listed in columns B are not uncommon; they can be obtained, especially if the farmer practices fertilization heavier than that considered practical at the time of survey. It usually requires at least two rotation cycles under the better, or high, level of management to bring yields given in column A up to those in column B.

The yields given may be surpassed in the future as better management practices are found and higher yielding crop varieties are developed.

GROUP 1.—NEARLY LEVEL WELL DRAINED AND IMPERFECTLY DRAINED LOAM SOILS OF THE BOTTOM LANDS

Group 1 consists of soils good to excellent for crops and pasture. They have characteristics that suit them to intensive cropping, but as a group are somewhat limited by susceptibility to periodic flooding and imperfect drainage. All are relatively fertile; they produce, without addition of amendments, comparatively high yields of the crops to which they are adapted. They are moderately well supplied with lime, organic matter, and plant nutrients and are replenished periodically by deposits of fresh sediments. Moisture content and tilth are favorable for plant growth most of the time. Cobbles and gravel in Staser cobbly fine sandy loam interfere with many field operations, chiefly cultivation and mowing.

These soils are well suited to corn and to annual hay crops grown in summer. Alfalfa is poorly suited, but it is grown successfully in

[7] Cow-acre-days is used to express the carrying capacity of pasture. It is the product of the number of animal units carried per acre multiplied by the number of days during the year the animals are grazed without injury to pasture. For example, a soil that supports 1 animal unit per acre for 360 days rates 360; one that supports 1 animal unit on 2 acres for 180 days rates 90; and one that supports 1 animal unit on 4 acres for 100 days rates 25.

places. Apparently, red clover is better. Small grains are generally more susceptible to lodging and disease and generally mature later than on upland soils. Tobacco also is poorly suited. Cabbage, green beans, and many vegetable crops are well suited to most of the soils. The imperfectly drained soils—Lindside, Hamblen, and Chewacla—probably have moisture relations better for grasses and corn than for alfalfa, small grains, and green beans.

Management requirements.—The selection of adapted crops is especially important. Adapted crops can be grown successfully almost continuously, but a short rotation is desirable on most farms. A corn-hay rotation should be especially well suited to the imperfectly drained soils. A corn-wheat-red clover rotation is successful on the well-drained soils on some farms. Crimson clover and other winter legumes plowed under as green manure in spring should prove beneficial, especially where corn is grown every summer. Vegetable crops, as cabbage or green beans, can be substituted for the corn in these rotations.

Although good crop yields are obtained without amendments, some fertilizer is required to maintain high yields under intensive use. Most soils respond to fertilizer. Lime and phosphate are generally required to establish and maintain red clover. Practically all crops will show good response to liberal applications of phosphate. A moderate application of potash may be needed, depending on the crop grown and the previous cropping system. Nitrogen fertilizer is necessary for high yields under continuous cropping, although legumes grown in the crop rotation will supply an appreciable amount.

Estimated yields of principal crops grown in soils of this group are listed in table 6.

GROUP 2.—NEARLY LEVEL EXCESSIVELY DRAINED VERY SANDY SOILS OF THE BOTTOM LANDS

The one soil in group 2—Buncombe loamy fine sand—is fair for either crops or pasture. Because it is very sandy, it is droughty for all but very deep-rooted crops and plant nutrients are leached from it readily. Its natural fertility is low, but it is benefited by overflow. It is very easily worked, and weeds are easily controlled, but the very sandy texture interferes with the manipulation of heavy machinery. Erosion is a hazard only where floodwaters may scour away the soil.

This soil is suited to intensive use for row crops, but heavy fertilization with all plant nutrients is required. Melons and such early truck crops as potatoes, beans, and cabbage are well suited where fertility is maintained. General farm crops such as corn, small grains, and red clover produce fair to good yields. Bermuda grass develops a good cover and affords a fair quantity of good grazing. Frequent small applications of complete fertilizer are required for good yields of all crops, and frequent incorporation of organic matter would help maintain productivity.

Management requirements.—Special methods of tillage or cropping to maintain tilth or control runoff are normally not necessary. Good tilth is easily maintained. The soil can be tilled over a wide range of moisture conditions without serious injury. It is ordinarily not susceptible to erosion, though it may be necessary to build up stream

TABLE 6.—*Estimated average acre yields of principal crops to be expected on soil*
County, Tenn.

[Yields in columns A to be expected under the level of management used by most farmers in the cou
under better management. (See text discussion of management group 1) Blank spaces inc
soil or is not considered suitable for it]

Soil	Corn		Wheat		Oats		Lespedeza hay		Red cl
	A	B	A	B	A	B	A	B	A
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*
Chewacla fine sandy loam [1]	38	60	----	20	----	45	1. 1	1. 8	------
Congaree fine sandy loam	40	60	14	19	30	45	1. 2	1. 7	1. 4
Congaree loam	45	70	15	20	35	50	1. 3	1. 8	1. 5
Hamblen silt loam [1]	40	60	----	----	----	----	1. 0	1. 6	------
Hamblen fine sandy loam [1]	30	55	----	----	----	----	. 9	1. 5	------
Lindside silt loam	45	63	----	----	----	----	1. 2	1. 6	------
Staser fine sandy loam	40	60	14	18	25	43	1. 1	1. 6	1. 3
Staser cobbly fine sandy loam	35	55	13	17	23	40	1. 0	1. 5	1. 2
Staser silt loam	45	65	15	20	30	45	1. 2	1. 7	1. 4

[1] Yields in columns A without artificial drainage; those in columns B, with adequate drainag

banks in places to prevent scouring. The range of use suitability and general productivity of the imperfectly drained areas probably could be increased by artificial drainage. The advisability of drainage and the kind of drains to use for any particular area will depend on cost, feasibility of drainage from an engineering standpoint, kinds and acreages of other soils on the farm, and related factors.

See table 7 for estimated average acre yields of principal crops to be expected on the soil of group 2.

GROUP 3.—NEARLY LEVEL, UNDULATING, AND ROLLING YOUNG SOILS OF THE COLLUVIAL LANDS

In group 3 are soils good to excellent for crops and pasture. They are suited to intensive cropping and are well adapted to practically all the common crops grown. They ordinarily are not susceptible to flooding and therefore have a wider range of adaptation than soils of group 1. All are deep, permeable soils with moisture conditions favorable for plants. Most soils in the group are well drained, but some are imperfectly drained. On the latter, moisture conditions are unfavorable for the growth of many crops in wet seasons.

The content of organic matter and plant nutrients is moderate to high; the water-holding capacity is high. Although not commonly susceptible to flooding, these soils do receive some sediment from the adjacent slopes. These deposits tend to replenish the content of plant nutrients and organic matter. Good tilth is easily maintained, and tillage can be carried on over a fairly wide range of moisture conditions without injury to the soils. Nevertheless, wetness in spring and after heavy rains delays field operations on the less well drained soils.

These soils are adapted to a wide variety of crops. They are well suited to corn and hay crops, but are not especially good for small grains, as they tend to lodge. Alfalfa is successfully grown on the better drained soils, though soils of groups 4 and 6 are probably better suited. The better drained soils of group 3 are especially well suited to tobacco, red clover, and most vegetables.

Management requirements.—Although good yields are obtained under almost continuous use for row crops, a short rotation is desirable on most farms. A rotation of corn, wheat, red clover, and tobacco seems well suited. Almost any of the vegetable crops can be substituted for the corn or tobacco, and oats or barley for the wheat. Alfalfa can replace the red clover, but this change would require a longer rotation. Also, some areas may not be sufficiently drained for alfalfa. On farms with a small acreage of cropland, it may be necessary to use these soils almost continuously for row crops. A rotation of tobacco and crimson clover is advisable for such farms. Corn, potatoes, cabbage, or green beans can be substituted for the tobacco.

Although their fertility is moderately high compared with that of other soils in the county, the soils of group 3 will show excellent response to fertilizer. Nitrogen fertilizer is generally needed if nitrogen is not supplied by legumes in the crop rotation. Phosphate is usually required for high yields of most crops. Potash is less likely to be deficient, though some crops may need it. None of the soils are especially low in lime, but lime would benefit most areas, and in some places is necessary for satisfactory growth of red clover and alfalfa.

TABLE 7.—*Estimated average acre yields of principal crops to be expected on so*
County, Tenn.

[Yields in columns A to be expected under the level of management used by most farmers in the cou
under better management. (See text discussion of management group 2) Blank spaces in
soil or is not considered suitable for it]

Soil	Corn		Wheat		Oats		Lespedeza hay		Red cl	
	A	B	A	B	A	B	A	B	A	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	
Buncombe loamy fine sand	15	30	5	10	10	25	0. 5	0. 8	0. 7	

Ordinarily no special tillage or water-control practices are necessary. Runoff is a problem only in those few places where some of the soils receive excess water from the slopes above. In such places there is danger of damage from erosion and from deposition of heavy material washed from the slopes above that are eroding rapidly. Diversion of the runoff from such slopes may be desirable. Good tilth is easily maintained except on the wettest areas. Tillage can be done over a fairly wide range of moisture conditions without seriously impairing the physical properties of the soils.

These soils are highly productive of pasture and are especially valuable because they remain moist longer during hot, dry periods. Phosphate is the chief requirement for pasture, though lime probably will be needed, especially on the Barbourville, Cotaco, and Greendale soils. Grazing should be controlled, and occasional mowing may be necessary to remove excess herbage and weeds.

Estimated average acre yields of principal crops to be expected on soils of group 3 are listed in table 8.

GROUP 4.—UNDULATING DEEP FRIABLE RED AND BROWN SOILS

The soils of group 4 are good to excellent for both tilled crops and pasture. All are at least moderately high in fertility, fairly easy to work, and productive of most of the crops commonly grown. The gentle slopes are neither seriously eroded nor susceptible to erosion. The stronger slopes are moderately eroded and require special management. Compared with many soils of the uplands, those of group 4 have moderate to high content of organic matter and plant nutrients and moisture conditions favorable for plant growth. They are not stony, and tilth conditions are good to excellent.

These soils are well suited to practically all crops commonly grown in the area but are especially valuable for tobacco and cabbage, green beans, potatoes, and other vegetables. With proper fertilization and liming, alfalfa and red clover are successful crops. These soils are not so productive of corn as group 1 soils, but are better suited to corn than most soils of the upland.

Management requirements.—Group 4 soils are suited to moderately intensive use for crops. When other management requirements are met, they can be conserved and their productivity maintained or increased under a 3- or 4-year rotation. Winter legumes and green-manure crops are useful in conserving soil moisture, improving tilth, and providing nitrogen and humus. In planning the choice and rotation of crops, it should be kept in mind that these soils are well suited to such exacting deep-rooted legumes as alfalfa and red clover. A rotation consisting of corn, a small grain, and red clover and grass should be well suited. Any of the truck crops or tobacco can be substituted for the corn in this rotation. Another suitable cropping system consists of an intertilled crop followed by a small grain and grass-legume hay. The more sloping areas require somewhat long rotations that maintain close-growing cover on them a greater part of the time. Field operations on the contour should help prevent losses of soil material through runoff.

For high yields of most of the crops commonly grown, these soils are moderately deficient in lime, phosphorus, nitrogen, and possibly potash. They show excellent response to lime and fertilizer. Mod-

TABLE 8.—*Estimated average acre yields of principal crops to be expected on so*
County, Tenn.

[Yields in columns A to be expected under level of management used by most farmers in the cou
under better management. (See text discussion of management group 3) Blank spaces ind
soil or is not considered suitable for it]

Soil	Corn		Wheat		Oats		Lespedeza hay		Red cl	
	A	B	A	B	A	B	A	B	A	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	
Augusta silt loam [1]	40	60					1. 0	1. 6		
Barbourville fine sandy loam	30	45	14	20	22	40	. 9	1. 3	1. 2	
Barbourville silt loam	32	60	14	20	25	40	1. 0	1. 6	1. 3	
Barbourville stony fine sandy loam	25	45	12	18	20	35	. 7	1. 2	1. 0	
Camp silt loam	30	55	14	23	35	55	1. 2	1. 9	1. 4	
Cotaco fine sandy loam [1]	22	48	9	15	18	28	. 7	1. 2		
Emory silt loam	45	65	19	27	37	52	1. 2	1. 8	1. 6	
Greendale silt loam	40	60	18	24	33	43	1. 1	1. 6	1. 4	
Ooltewah silt loam [1]	45	63					1. 2	1. 6		
Tusquitee silt loam, rolling phase	43	60	18	26	36	50	1. 1	1. 7	1. 5	
Whitesburg silt loam [1]	40	55	14	20	30	40	1. 1	1. 6	1. 4	

[1] In columns A are yields to be expected without artificial drainage, in columns B, yields to

erate applications of lime and phosphate are necessary for the successful growth of the deep-rooted legumes such as alfalfa and red clover and greatly increase yields of other legumes. Nitrogen is required for high yields of practically all crops except legumes and the crops immediately following them. Most crops give a good response to phosphate. The Sequatchie, Nolichucky, and Waynesboro soils are likely to be deficient in potash for many crops, especially deep-rooted legumes. The other soils seem to have adequate potash for most crops. Heavy applications of a complete high grade fertilizer are desirable for vegetable crops, tobacco, or potatoes. Properly conserved manure is an excellent source of both nitrogen and potash but should be supplemented with phosphate to obtain a balance of plant nutrients.

All of these soils are productive of pasture. With moderate applications of lime and phosphorus, proper seeding, and control of weeds, they are capable of maintaining productive pasture of excellent quality.

Estimated average acre yields of principal crops are listed for soils of group 4 in table 9.

GROUP 5.—UNDULATING FRIABLE YELLOW SOILS

The soils of group 5 are fair to good for crops and fair to very good for pasture. Except for the Monongahela soils that should not be tilled when excessively moist, all can be conserved rather easily. The more sloping areas of all these soils should be tilled along the contour, but terraces or other engineering devices for runoff control should not be necessary under good management. All of the soils are easy to work when moisture conditions are favorable. Natural productivity ranges from low to moderate. The Altavista and Holston soils are permeable, but internal drainage and percolation are somewhat retarded in the Monongahela and Leadvale soils. Most rainfall is absorbed, however, and supplies of available moisture for plants are moderate. Only a very small acreage has cobbles or pieces of gravel in numbers that interfere with cultivation.

Altavista and Holston soils are suited to a wide variety of crops—corn, wheat, oats, barley, tobacco, many vegetable crops, and the common hay and pasture crops, including alfalfa and red clover. The suitability of the Monongahela and Leadvale soils is more limited because of imperfect drainage; they are not suitable for vegetables, tobacco, and alfalfa.

Management requirements.—These soils require more exacting management than those of group 3, chiefly because of their low fertility. Longer rotations and heavier applications of fertilizer are needed, and it is important that a cover crop follow an intertilled crop. If other management practices are good, the soils can be maintained in a 3- or 4-year rotation. Corn, a small grain, and then clover and orchard grass for 2 or 3 years is a well-suited rotation. Tobacco or other row crops can be substituted for the corn on the better drained soils, and crimson clover instead of small grain can be used to advantage as a winter cover at least part of the time.

These soils have varying degrees of deficiency in lime, phosphorus, potash, and nitrogen. All crops respond well to heavy fertilization. Red and white clovers, alfalfa, and other legumes require lime,

TABLE 9.—*Estimated average acre yields of principal crops to be expected on so*
County, Tenn.

[Yields in columns A to be expected under the level of management used by most farmers in the co
under better management. (See text discussion of management

Soil	Corn		Wheat		Oats		Lespedeza hay		Red cl	
	A	B	A	B	A	B	A	B	A	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	
Cumberland silty clay loam, eroded undulating phase	35	60	16	28	38	60	1. 1	1. 6	1. 4	
Nolichucky loam, undulating phase	30	48	11	19	23	35	. 9	1. 2	1. 2	
Sequatchie fine sandy loam	35	50	16	23	25	43	1. 0	1. 4	1. 3	
State loam	40	60	18	25	30	50	1. 0	1. 6	1. 4	
Waynesboro loam, undulating phase	35	53	18	26	30	50	1. 0	1. 4	1. 4	

phosphorus, and some potash if they are to make good stands. If these legumes are properly inoculated, nitrogen fertilizer is required only to get the stand established. Truck crops and tobacco require heavy applications of complete fertilizer. The low organic-matter content makes barnyard manure a desirable fertilizer, but it should be supplemented with phosphate in order to maintain a balance of plant nutrients.

All of these soils are suited to pasture, but they do not produce forage of good quality unless they are fertilized. Application of lime, phosphorus, and potash, proper seeding, and controlled grazing are important. Weeds and excess herbage should be removed by mowing at intervals during the growing season.

Estimated average acre yields of principal crops are listed for soils of group 5 in table 10.

GROUP 6.—ROLLING FIRM RED TO REDDISH-YELLOW SOILS

In group 6 are reddish-brown to reddish-yellow soils with a firm to moderately heavy subsoil. All are well drained, moderately deep or deep to bedrock, and medium to strongly acid. They are sloping or rolling, the gradient ranging up to about 12 percent. A small acreage contains stones or cobbles that interfere with cultivation. These soils are susceptible to erosion; most areas have lost a part of the surface soil. Compared with other soils suitable for crops except those on bottom lands, these soils are relatively high in organic matter and plant nutrients and have a fairly high moisture-holding capacity. Their present fertility depends somewhat on the past cropping system and on the quantity of soil material lost as a result of accelerated erosion.

These soils are suited to a wide variety of crops, including corn, wheat, oats, barley, and tobacco. All except the Dunmore soils are at least fairly well suited to vegetables. All are well suited to legumes-and-grass hay crops, and especially to alfalfa and red clover.

Management requirements.—Chiefly because of their stronger slopes, these soils are much more exacting in management requirements than those of groups 1 to 4. Rotations should be longer and include more close-growing crops. Growing selected crops in proper rotation is important in maintaining or increasing the productivity of these soils. Row crops should be alternated with close-growing crops, and the regular use of deep-rooted legumes is particularly beneficial. Observations indicate that a row crop can be grown safely once every 4 to 6 years. If fertilization and other management practices are good, a rotation consisting of corn, a small grain, and alfalfa for 4 years appears well suited. A winter cover crop (fall-sown small grains or a legume) should follow all clean-cultivated crops. Legume-and-grass hay or pasture should be grown periodically to help maintain supplies of organic matter and to stabilize the soil. If such hay or pasture crops are not grown, more green-manure crops can well be used.

These soils are deficient in lime, phosphorus, and nitrogen, but they vary considerably in degree of deficiency. The Nolichucky soils are more deficient in these than the others and are also the most likely to be deficient in potash. Legumes, especially deep-rooted ones, require lime, phosphorus, and potash; but, if inoculated and otherwise

TABLE 10.—*Estimated average acre yields of principal crops to be expected on so*
County, Tenn.

[Yields in columns A to be expected under the level of management used by most farmers in th
pected under better management. (See text discussion of management

Soil	Corn		Wheat		Oats		Lespedeza hay		Red cl	
	A	B	A	B	A	B	A	B	A	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	
Altavista loam	30	48	11	19	23	35	0. 9	1. 2	1. 2	
Holston loam, undulating phase	23	43	10	18	20	33	. 8	1. 2	1. 2	
Leadvale silt loam:										
Undulating phase	30	45	10	18	20	33	. 9	1. 2	1. 3	
Rolling phase	20	35	9	16	18	30	. 7	1. 1	1. 1	
Monongahela silt loam [1]	18	38	8	15	16	28	. 6	1. 0	1. 0	
Eroded phase [1]	16	36	7	14	14	27	. 5	1. 0	1. 0	

[1] Yields in columns A are without artificial drainage; those in columns B, with adequate draina

well fertilized, do not need nitrogen. An inoculated legume, if turned under, will generally supply adequate nitrogen for the crop that follows it. All crops respond well to phosphorus. Heavy applications of complete fertilizer are needed for high yields of truck crops and tobacco. Barnyard manure is a good source of nitrogen and potash, but it should be supplemented with a phosphate fertilizer so that a good balance of nutrients will be maintained.

Except on the most eroded areas of the Dunmore soils, good tilth is easily maintained and tillage can be carried on over a moderate range of moisture conditions. The moderately strong slopes interfere with field operations, and erosion is a great hazard. Erosion control, however, is not a serious problem if the suggested rotations are followed and field work is done on the contour. It may be feasible to practice contour strip cropping on the longer slopes. Terraces or other engineering devices for runoff control are not necessary if other good management requirements are fulfilled. If it is necessary to use short rotations, however, terracing may be feasible in places.

These soils are well suited to pasture, but are not so productive of forage as soils of groups 1 and 3 because they have a less favorable moisture supply. Pasture management consists chiefly of supplying lime, phosphorus, and probably potash, proper seeding, and control of the vegetation by proper grazing and the mowing of weeds and excess herbage.

See table 11 for estimated average acre yields of principal crops on soils of group 6.

GROUP 7.—ROLLING NONSTONY YELLOW SOILS

All soils of group 7 are acid, low in fertility, moderate in productivity, and rolling in relief (up to 12 percent slopes). They are moderately deep or deep to bedrock and have moderate water-holding capacity. All are relatively free of stones, but a few areas of Holston and Jefferson soils have cobbles sufficient to interfere with cultivation. All but the occasional severely eroded areas have good tilth.

The Holston and Jefferson soils are permeable. The heavy firm subsoil of much of the Groseclose acreage retards percolation. As a result of erosion, many areas have a plow layer that includes some of the heavier subsoil material. Especially in many areas of Groseclose soil, this admixture of subsoil has caused unfavorable tilth. All these soils have adequate surface and internal drainage for most crops. They are suited to corn, wheat, oats, barley, tobacco, and many vegetables. Groseclose soils are somewhat less well suited to truck crops than the others. Alfalfa and red clover can be grown successfully if properly managed and fertilized. In general, the soils of this group are better suited to small grains than to corn.

Management requirements.—These soils require more exacting management than soils of group 4 chiefly because they have stronger slopes and lower fertility. Adequate control of runoff is more important, so a longer rotation that includes more close-growing crops will be needed. If other management practices are good, these soils can be kept productive by using 4- to 6-year rotations. A rotation of corn, a small grain, and clover and orchard grass for 3 years is well suited. Tobacco, followed by crimson clover as a winter cover crop, can be used in place of corn. On the Holston, Jefferson, and uneroded

TABLE 11.—*Estimated average acre yields of principal crops to be expected on so*
County, Tenn.

[Yields in columns A to be expected under the level of management used by most farmers in the co
under better management. (See text discussion of management fo

Soil	Corn		Wheat		Oats		Lespedeza hay		Red cl
	A	B	A	B	A	B	A	B	A
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*
Allen fine sandy loam:									
Rolling phase	32	50	16	25	28	47	0. 9	1. 3	1. 3
Eroded rolling phase	30	48	15	23	25	45	. 8	1. 2	1. 2
Dewey silty clay loam, eroded rolling phase	28	53	15	24	30	50	1. 0	1. 4	1. 3
Dunmore silt loam, rolling phase	25	50	14	20	28	45	1. 0	1. 3	1. 2
Dunmore silty clay loam, eroded rolling phase	30	45	12	18	22	40	. 8	1. 3	1. 1
Hayter silt loam, eroded rolling phase	30	45	14	20	25	40	. 8	1. 3	1. 1
Nolichucky loam, eroded rolling phase	25	40	9	16	18	30	. 8	1. 1	1. 1
Waynesboro loam, eroded rolling phase	30	48	15	23	25	45	. 8	1. 2	1. 2

Groseclose soils, almost any of the other row crops commonly grown can be substituted for the corn. The more eroded parts of the Groseclose soils are normally not suited to row crops and vegetables. Where fertility is sufficiently improved, a rotation of corn, a small grain, and alfalfa for 4 years is well suited. In general, it is important that a cover crop directly follow all intertilled crops, as the soils need a cover during winter that will protect them from erosion.

The soils of this group require heavier fertilization than those of groups 4 and 6. In their natural state their supplies of lime, phosphorus, potash, and nitrogen are not sufficient to produce high yields of most crops. The legumes, especially the deep-rooted ones, require lime and phosphorus, and generally potassium. If the legume is inoculated, nitrogen is not needed after it becomes established. All crops respond well to phosphate fertilizer. Truck crops need heavy applications of a complete fertilizer.

Except on the more eroded parts of the Groseclose soils, good tilth is easily maintained and tillage can be carried on over a fairly wide range of moisture conditions. Although all these soils are susceptible to erosion, control of runoff and attendant erosion should not be a serious problem if suitable rotations are used. All tillage should be on the contour, and strip cropping of longer slopes may be advisable. Terraces or other engineering devices for controlling runoff should not be necessary unless rotations shorter than those suggested are used. The soils are sufficiently deep and permeable and generally of such regularity in slope that terracing should be suitable if outlets are available.

These soils are especially suited to pasture, but large applications of lime and phosphate are required to maintain vegetation of good quality and quantity. Moderate applications of potash fertilizer probably will be needed when pastures are seeded. Other requirements are proper control of grazing and the removal of weeds and excess herbage by mowing.

See table 12 for estimated average acre yields of principal crops on soils of this group.

GROUP 8.—UNDULATING AND ROLLING STONY FRIABLE REDDISH-YELLOW AND YELLOW SOILS ON STREAM TERRACES AND COLLUVIAL SLOPES

The soils of group 8 are fair for crops and fair to good for pasture. They are characterized by stones or cobbles on and in the soil in numbers that interfere with cultivation, but are suitable for crop production. All are deep, well-drained, medium to strongly acid, and moderate to low in plant nutrients, organic matter, and water-holding capacity. All are permeable to roots and water.

These soils are suited to most of the crops of the county, though their usefulness is somewhat limited by stoniness and droughtiness. Their permeable and friable nature favors their use for early vegetables, but the stones are a detriment when intense cultivation is required. They are fairly well suited to such crops as crimson clover, and small grains, though the stones interfere with mowing. They are not so well suited to crops that mature late in summer or early in fall as soils of groups 1 and 3.

Management requirements.—These soils are suited to crops, but it may be desirable on many farms to use them mainly for pasture be-

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TABLE 12.—*Estimated average acre yields of principal crops to be expected on soi*

[Yields in columns A to be expected under the level of management used by most farmers in th
pected under better management. (See text discussion for manageme

Soil	Corn		Wheat		Oats		Lespedeza hay		Red cl	
	A	B	A	B	A	B	A	B	A	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	
Groseclose silt loam, rolling phase	30	43	12	18	22	40	0. 8	1. 3	1. 1	
Groseclose silty clay loam, eroded rolling phase	25	38	10	17	19	33	. 7	1. 1	. 9	
Holston loam, eroded rolling phase	18	38	9	16	18	30	. 7	1. 1	1. 0	
Jefferson loam, eroded rolling phase	30	48	15	23	25	45	. 8	1. 2	1. 2	

cause of difficulty in tillage. Many farmers favor a long rotation such as corn, wheat, and then pasture for 3 to 5 years. If a more intensive use is necessary, a rotation of corn, a small grain, and then red clover and grass for 3 years is suitable. Any of the commonly grown row crops can be substituted for the corn in this rotation.

These soils do not have sufficient lime, phosphorus, potash, and nitrogen for high yields of most crops. Applications of lime, phospate, and potash are especially needed for successful growth of alfalfa and red clover. Practically all crops respond to phosphate. Nitrogen is also essential for high yields of all crops except legumes. Barnyard manure is an excellent source of nitrogen, potash, and organic matter for all crops.

These soils are susceptible to erosion. Tillage should be on the contour where feasible. Engineering devices for water control should not be necessary if fertilization is adequate and a crop rotation similar to those suggested is used. Workability could be improved by removing loose stones, but this would be practical for only small areas.

Soils of this group are fair to good for pasture. Establishing and maintaining high yielding pastures of good quality usually requires moderate to heavy applications of lime, phosphate, and potassium. A pasture mixture of bluegrass, orchard grass, redtop, white and hop clovers, and lespedeza is well suited. Controlled grazing and removal of excess herbage and weeds are also good practices.

Estimated average acre yields of principal crops are listed for soils of group 8 in table 13.

GROUP 9.—ROLLING DEEP AND MODERATELY DEEP SEVERELY ERODED SOILS

Group 9 consists of rolling firm severely eroded soils at least moderately deep to bedrock. Small gullies make the surface irregular. The plow layers consist of clay subsoil material and are much firmer and less friable than those of the less eroded soils of the same soil series. Percolation is slower than for the less eroded phases. Supplies of moisture and the content of organic matter and plant nutrients are low. The range of moisture content suitable for cultivation is narrow. The soils break to hard lumps if worked when dry and puddle and form hard intractable clods if worked too wet. Unfavorable conditions for plant growth, the slow rate of moisture absorption, and the moderately strong slope make erosion a great hazard.

Soils of group 9 are of limited suitability for agriculture and especially poor for row crops. Close-growing crops such as fall-sown grasses and legume-and-grass mixtures for hay and pasture, particularly grass with perennial legumes, are better suited.

Management requirements.—The principal management problems are (1) improving the physical condition of the soils so they will absorb and hold adequate water for plant growth, (2) improving tilth, and (3) controlling runoff and erosion. Proper choice and rotation of crops, addition of organic matter, and care in tillage are therefore general requirements. Deep-rooted legume crops such as alfalfa, sweetclover, and lespedeza sericea and green-manure crops such as crimson clover and vetch can be used effectively to improve the physical condition and help maintain organic matter and nitrogen.

One of the better crop rotations consists of a small grain for one year and then a leguminous hay crop or legume-and-grass pasture for

TABLE 13.—*Estimated average acre yields of principal crops to be expected on so*
County, Tenn.

[Yields in columns A to be expected under the level of management used by most farmers in the co
under better management. (See text discussion of management

Soil	Corn		Wheat		Oats		Lespedeza hay		Red cl	
	A	B	A	B	A	B	A	B	A	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	
Holston cobbly loam:										
Undulating phase	20	40	9	17	19	32	0.8	1.2	1.1	
Rolling phase	18	38	9	16	18	30	.7	1.1	1.0	
Eroded rolling phase	17	36	8	15	17	28	.6	1.0	.9	
Jefferson stony sandy loam:										
Rolling phase	15	35	7	15	14	30	.5	1.1	.9	
Eroded rolling phase	14	33	6	14	12	28	.5	1.0	.8	
Nolichucky cobbly loam:										
Rolling phase	23	39	8	15	17	29	.8	1.1	1.1	
Eroded rolling phase	23	39	8	15	17	29	.8	1.1	1.1	
Sequatchie cobbly fine sandy loam	33	50	15	22	25	40	.9	1.4	1.2	

4 or 5 years. A 1-year rotation consisting of a small grain and lespedeza might also be used. The use of such a cropping system depends on the type of farming, the acreage of arable land available, and the availability of the necessary equipment. The small grain-lespedeza rotation generally is not desirable until the productivity of the soil has been restored through addition of plant nutrients and incorporation of organic matter. If a row crop must be grown, it should always be followed by a cover crop.

Any good plan of management of these soils includes use of lime and fertilizers. The soils are very deficient in nitrogen and phosphorus for practically all crops and usually lack the potash needed for deep-rooted legumes. Manure supplies plant nutrients and improves the tilth and water-absorbing properties of the soils. Lime, especially, is necessary for maintaining good stands of alfalfa, red clover, or other legumes.

Control of runoff and erosion are important. Contour tillage should be followed wherever feasible, and close-growing crops are desirable for protecting the soils. If the soils are tilled in fall, cover crops are needed to protect them during winter and to supply organic matter when they are turned in spring. Terracing is usually not advisable on these heavy soils, but strip cropping may be feasible on the longer slopes.

Good tilth is difficult to maintain, but incorporating organic matter in the soil will help. Cultivation needs to be kept at a minimum. Tillage should be restricted to the narrow range in which moisture conditions are favorable.

Where these soils are in pasture already well established, requirements are chiefly periodic applications of lime and phosphate, mowing to control weeds, and occasional reseeding. If fertilization is adequate, grazing is properly controlled, and weeds are systematically eradicated, reseeding ordinarily will not be necessary. On the contrary, the pastures should improve with age.

Where pastures are not yet established, management is difficult. Problems confronted include unfavorable tilth, tendency to clod and bake, slow absorption of moisture, and extreme deficiency in organic matter. Lime and phosphate are necessary, potash may be needed, and nitrogen can be expected to aid in getting desirable vegetation established. Pasture mixtures should have a large proportion of drought-resistant plants. Seeding of alfalfa or lespedeza sericea on properly fertilized fields, grazing after they are well established, and seeding a pasture mixture on the stubble are considered good practices. Applications of barnyard manure are especially helpful in establishing pasture plants on galled areas.

See table 14 for estimated average acre yields of principal crops on soils of this group.

GROUP 10.—HILLY NONSTONY MODERATELY FERTILE SOILS WITH FRIABLE SURFACE SOILS AND MODERATE DEPTH TO BEDROCK

The soils of group 10 differ from those of group 6 chiefly in having stronger slopes (12 to 25 percent). They are poor to fair for crops and fair to very good for pasture. Because of the strong slopes, field operations and adequate control of runoff are difficult. Consequently, a higher level of management than that for soils of group 6 is re-

TABLE 14.—*Estimated average acre yields of principal crops to be expected on so*
County, Tenn.

[Yields in columns A to be expected under the level of management used by most farmers in the co
under better management. (See text discussion of management for soils of group 9.) Bla
grown on the soil or is not considered suitable for it. Tobacco is not suitable for any of the

Soil	Corn		Wheat		Oats		I
	A	B	A	B	A	B	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*To*
Dunmore silty clay, severely eroded rolling phase	10	25	5	13	10	25	0
Holston clay loam, severely eroded rolling phase	8	22	5	12	8	23	
Jefferson stony sandy clay loam, severely eroded rolling phase	8	22	5	12	8	23	
Nolichucky clay loam, severely eroded rolling phase	----	22	----	12	----	23	---
Waynesboro clay loam, severely eroded rolling phase	18	40	5	18	10	35	

quired to maintain them. They are moderately deep to bedrock and well drained. The Tusquitee, Waynesboro, Allen, and Dewey soils are moderately permeable. The Dunmore soils, though adequately drained, are somewhat more slowly permeable. All the soils are moderately supplied with organic matter and plant nutrients, but there is some variation owing to a variable degree of erosion and to past cropping and fertilization. All of these soils have a fairly good water-holding capacity. None contain stones enough to interfere with tillage, although a few acreas have some cobbles or gravel.

Legumes and grasses for hay and pasture are preferred crops for these soils. With adequate fertilization, alfalfa and red clover are the outstanding hay crops. Fall-sown small grains (wheat, oats, and barley), corn, tobacco, and many vegetables are also suited, but the row crops should not be grown in short rotations. Vegetables, especially root crops such as potatoes, are not well suited to the more eroded areas of the Dunmore and Dewey soils.

Management requirements.—These soils are exacting in management requirements. Great care in selection and time of tillage practices, proper and adequate fertilization, and use of long rotations consisting chiefly of close-growing crops are necessary. A rotation of corn, a fall-sown small grain, and red clover and orchard grass for 4 years is suitable for most areas. A rotation consisting of a small grain, red clover, and orchard grass for 3 years can be used; it leaves out the row crop entirely and would give greater protection from erosion. A rotation consisting of a small grain seeded in contour furrows and followed by lespedeza is successfully used by a few farmers.

These soils are deficient in lime, phosphorus, and nitrogen. They vary considerably in degree of deficiency. Legumes and grasses especially require lime and phosphorus. If inoculated, legumes grown alone or with grasses do not commonly require nitrogen after a good stand has been established. Potash may be needed for the deep-rooted crops, and for such crops as potatoes. All crops respond well to applications of phosphate. Heavy applications of fertilizer are required for truck crops and tobacco.

Good tilth is easily maintained on the uneroded soils, for they can be worked over a wide range of moisture conditions. The eroded phases, especially of the Dunmore and Dewey soils, are subject to puddling and clodding and can be tilled only over a narrow range of moisture content. Growing of grasses, deep-rooted legumes, and green-manure crops and application of barnyard manure will tend to improve tilth. Loss of soil material through surface runoff is difficult to control when the soils are cultivated. This loss can be minimized by using a long rotation consisting chiefly of close-growing crops and by doing all tillage on the contour. Contour strip cropping may be advisable for the longer slopes. Where contour tillage or strip cropping are not feasible because of very irregular slopes, the omission of row crops should be considered.

These soils are physically well suited to pasture and on many farms are probably best used for that purpose. Management is concerned mainly with supplying amendments, chiefly lime and phosphate, to suitable pasture plants. Pasture stands are somewhat difficult to establish on the more severely eroded areas. Barnyard manure and nitrate fertilizers help greatly on these spots. After the pasture is

established, the legumes in the mixture should supply most of the nitrogen needed for high yields. Grazing should be controlled so as to maintain a good sod at all times. Weed control is not a serious problem on pastures that receive adequate amendments and are properly grazed, but an occasional clipping may be necessary.

See table 15 for estimated average acre yields of principal crops to be expected on soils of this group.

GROUP 11.—HILLY SOILS OF LOW FERTILITY WITH FRIABLE SURFACE SOILS AND MODERATE DEPTH TO BEDROCK

Soils of group 11 are fair for crops and fair to good for pasture. They differ from the soils of group 7 chiefly in stronger slope (12 to 25 percent). They are moderately deep to bedrock, moderately permeable, well drained, and moderate to low in productivity. The organic-matter content and plant-nutrient supply are moderate to low, and the water-holding capacity is moderate. The soils are sufficiently permeable for most crops commonly grown, but the subsoil of the Groseclose soils is too firm or compact for root crops.

These soils are physically suited to a wide variety of crops, but their exacting management requirements limit the choice of crops and the frequency with which they can be grown. Fertilization is generally required for most crops, and it is essential for alfalfa and red clover. Moisture conditions and the strong slope make these soils poorly suited to intensive use, such as that required for tobacco and vegetables.

Management requirements.—Requirements are very exacting for the successful growth of crops, and on many farms the soils are probably best used for semipermanent hay or pasture. To maintain or increase productivity, a long rotation consisting chiefly of close-growing crops that are properly and adequately fertilized, is required. If other management practices are good, a row crop probably can be grown once in 5 or 6 years. Fall-sown small grains and perennial grass-and-legume hay and pasture crops should greatly dominate in the rotation. It is especially important that a cover crop follow the intertilled crop. Where the soils are kept in sod crops most of the time, erosion is minimized, soil moisture is conserved, and the supplies of nitrogen and humus are increased or maintained.

These soils, like those of group 7, are low in nitrogen, phosphorus, potash, and lime and require heavy fertilization to maintain a fairly high level of fertility. Small grains and grasses require complete fertilizers for high yields. Legumes or legume-and-grass mixtures require phosphorus and potash, but no ntirogen if properly inoculated. Lime is necessary to obtain good stands of legumes; it also improves the yields and quality of other crops in the rotation. As on other soils, barnyard manure in adequate quantities is an excellent source of nitrogen, potash, and organic matter. It is believed that amendments should be applied to meet the needs of a particular crop rather than in large quantities at long intervals.

Estimated average acre yields of principal crops are given for these soils in table 16.

GROUP 12.—ROLLING SOILS SHALLOW TO SHALE BEDROCK

Shallowness to bedrock and low fertility limit the productivity of soils in group 12. Because of the low capacity of these soils for

TABLE 15.—*Estimated average acre yields of principal crops to be expected on so*
County, Tenn.

[Yields in columns A to be expected under the level of management used by most farmers in the co
under better management. (See text discussion of management for soils of group 10.) B
grown on the soil or is not considered suitable for it.]

Soil	Corn		Wheat		Oats		Lespedeza hay		Red c
	A	B	A	B	A	B	A	B	A
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*
Allen fine sandy loam:									
Hilly phase	25	38	12	20	20	38	0. 8	1. 2	1. 1
Eroded hilly phase	23	35	11	19	18	35	. 7	1. 1	1. 0
Dewey silt loam, hilly phase	27	50	14	23	27	47	1. 0	1. 4	1. 3
Dewey silty clay loam, eroded hilly phase	25	40	13	21	20	40	. 9	1. 3	1. 3
Dunmore silt loam, hilly phase	----	40	----	18	----	38	------	1. 2	------
Dunmore silty clay loam, eroded hilly phase	23	35	11	16	20	35	. 6	1. 0	1. 0
Tusquitee silt loam, hilly phase	40	57	17	25	34	48	1. 0	1. 6	1. 4
Waynesboro loam, eroded hilly phase	23	35	11	19	18	35	. 7	1. 1	1. 0

TABLE 16.—*Estimated average acre yields of principal crops to be expected on soils*
County, Tenn.

[Yields in columns A to be expected under the level of management used by most farmers in the co
under better management. (See text discussion of management for soils of group 11.) Bla
grown on the soil or is not considered suitable for it. Tobacco is not suitable for any of the

Soil	Corn		Wheat		Oats		I
	A	B	A	B	A	B	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*T*
Groseclose silt loam, hilly phase	----	20	----	15	----	28	---
Groseclose silty clay loam, eroded hilly phase	10	18	6	14	10	25	
Holston loam, eroded hilly phase	14	25	7	14	13	25	
Jefferson-Dunmore complex:							
Hilly phases	22	38	12	17	20	35	---
Eroded hilly phases	20	35	10	15	18	32	---
Nolichucky loam:							
Hilly phase	----	30	----	16	----	30	---
Eroded hilly phase	18	28	8	15	13	28	

absorbing and retaining moisture, most areas are droughty during the drier parts of the growing season. Although low in fertility, the soils of this group do not greatly lack lime. Calcareous shale is at depths of 1 to 5 feet in most places. The soils are not well suited to intensive use required for growing tobacco and vegetables; available moisture is too limited. Hay and pasture and early-maturing crops such as small grains are best suited.

Management requirements.—Rotations of moderate length can be used, but the soils are droughty and dry out before row crops can mature. Low fertility and small moisture supply limit yields. Phosphorus, nitrogen, and organic matter are especially needed, and tests should be made to determine the need for lime. In many places, productivity can be increased by deep plowing or subsoiling that breaks up the underlying shale.

Erosion is a moderate hazard. The soil material is permeable, but shallowness to bedrock and moderate slope cause some loss of soil material. Almost any loss is important for soils as shallow as these. Tilth is good, although it is hindered by shale fragments. The siltiness of the material makes good tilth easy to maintain, and the soils can be cultivated over a fairly wide range of moisture conditions.

Much of the acreage is closely associated with extensive areas of hilly and steep soils suitable only for pasture. Because of the generally low productivity and the close association with soils of limited suitability, much of the area in this group is best used for pasture. With moderate applications of fertilizer (especially phosphorus), liming according to needs shown by soil tests, and proper seeding, bluegrass, white clover, lespedeza, orchard grass, and other pasture plants can be expected to supply good quality grazing of fair to moderate carrying capacity.

Estimated yields of principal crops for soils of group 12 are listed in table 17.

GROUP 13.—HILLY PERMEABLE LOAM SOILS ON HIGH MOUNTAINS

These soils are distinguished by their permeability and their high position on mountains where the climate is cooler and more humid and the growing season is shorter. Since moisture is absorbed rapidly, erosion is less a hazard than on hilly soils having more compact subsoils. Natural fertility is low, organic-matter content is moderate to low, and the reaction is strongly acid. Moisture relations are more favorable throughout a greater part of the growing season than for soils at the lower elevations. All of this group is much less accessible to good roads and markets than most other groups suited to crops. The permeable nature of these soils, with the cool, humid climate, makes them particularly well suited to small grains, hays, pasture, apples, and truck crops such as potatoes, late-season beans, and cabbage. Corn and tobacco are not so well suited to these soils as to most of those at lower elevations.

Management requirements.—A high state of productivity requires heavy fertilization, especially with phosphorus, organic matter, and lime. The requirement for potash is less than for soils developed over limestone in the valley part of the county, but response to it can be expected under average conditions. Some nitrogen fertilizer is necessary, though the need for it is lessened by the consistent use of legumes in the crop rotation.

TABLE 17.—*Estimated average acre yields of principal crops to be expected on soil*
County, Tenn.

[Yields in columns A to be expected under the level of management used by most farmers in th
pected under better management. (See text discussion of management for soils of group 12.)
is not grown on the soil or is not considered suitable for it.]

Soil	Corn		Wheat		Oats		Lespedeza hay		Red cl
	A	B	A	B	A	B	A	B	A
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*
Dandridge silt loam, rolling phase	14	20	6	10	17	25	0. 6	0. 8	0. 8
Dandridge shaly silt loam, eroded rolling phase	13	20	5	10	15	25	. 5	. 8	. 7
Dandridge and Litz silt loams, rolling phases	13	20	6	10	26	24	. 6	. 8	. 7
Dandridge and Litz shaly silt loams, eroded rolling phases	12	18	5	10	12	23	. 4	. 8	. 6
Litz shaly silt loam, eroded rolling phase	----	----	----	----	----	----	------	------	------

Although these soils are less subject to erosion than many others of similar slope, care is required to restrain runoff. A 5-year rotation consisting of corn or a truck crop, a small grain, and 3 years of hay is considered well suited. A close-growing cover crop should be maintained as much of the time as possible. All field operations should be on the contour; strip cropping may be feasible. Most slopes are too steep for terracing, but the less sloping parts on included ridge tops may be terraced where cultivated. Areas shallow to bedrock interfere with the satisfactory installation of terraces. North-facing slopes are best for apple orchards because damage from late spring frosts is less likely. Selection of suitable crop varieties, adequate fertilization, and control of insects are important features of good management. Legume cover crops help to maintain fertility and restrain runoff. Tilth is easily maintained, and excess moisture drains away shortly after rains.

All of these soils are capable of supporting good pasture. Pasture vegetation is less affected by the dry midsummer period than on soils at lower elevations, but the grazing season, or the period during which grasses grow well, is a little shorter. Legume-and-grass pasture mixtures that include white clover and bluegrass afford good grazing but require fertilization—especially with phosphorus and lime.

See table 18 for estimated average acre yields to be expected on soils of this group.

GROUP 14.—MODERATELY FERTILE STEEP AND STONY HILLY SOILS NOT WELL SUITED TO CROPS REQUIRING TILLAGE

All the soils of group 14, except areas of the Nolichucky, have moderate to high fertility. All are well drained. Their surface soils are friable; their subsoils at least moderately permeable and deep to bedrock. They retain plant nutrients well and have moderate water-holding capacity. Nevertheless, steep slope or a combination of hilly slopes and stoniness limits their suitability chiefly to pasture and forestry.

Management requirements.—Good quality pasture with a fairly high carrying capacity is not especailly difficult to maintain. Moderate applications of lime, fertilization with phosphorus, and proper soil preparation and seeding are the chief requirements. Mowing of weeds and excess herbage will aid in maintaining vegetation of high quality. White clover, bluegrass, Bermuda grass, orchard grass, fescue, and annual and serecia lespedezas are among the suitable pasture plants.

Areas needed for cultivated crops must be managed with great care to control runoff. The steep phases cannot be safely used for crops, and such use of the hilly areas should be avoided when feasible. Rotations of fall-sown small grains with hay and pasture crops consisting of perennial legumes and grasses are the most suitable insofar as the soils are concerned. Adequate fertilization and maintenance of a close-growing vegetative cover as much of the time as feasible are essential practices. Field operations should be on the contour, and strip cropping may be advisable. Terracing is not practicable on these soils.

Estimated average acre yields of principal crops are given for soils of group 14 in table 19.

TABLE 18.—*Estimated average acre yields of principal crops to be expected on soil*
County, Tenn.

[Yields in columns A to be expected under the level of management used by most farmers in the co
under better management. (See text discussion of management for so

Soil	Corn		Wheat		Oats		Lespedeza hay		Red c
	A	B	A	B	A	B	A	B	A
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*
Ashe loam, hilly phase	18	30	12	17	17	32	0. 7	1. 1	1. 0
Ashe loam, hilly dark-colored phase	20	33	13	18	18	35	. 8	1. 1	1. 1

TABLE 19.—*Estimated average acre yields of principal crops to be expected on*
Cocke County, Tenn.

[Yields in columns A to be expected under the level of management used by most farmers in the co
under better management. (See text discussion of management for soils of group 14) Blan
grown on the soil or is not considered suitable for it. Tobacco is not suitable for any of these s

Soil	Corn		Wheat		Oats		I
	A	B	A	B	A	B	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*T*
Allen stony fine sandy loam, eroded hilly phase	18	30	6	14	12	25	0
Dewey silty clay loam, eroded steep phase							
Dunmore silt loam, steep phase							
Dunmore silty clay loam, eroded steep phase							
Nolichucky cobbly loam:							
Hilly phase		28		13		24	
Eroded hilly phase	16	27	6	13	11	24	
Waynesboro cobbly loam, eroded hilly phase	20	32	9	16	15	30	

GROUP 15.—HILLY SOILS WITH COMPACT SURFACE SOILS

Soils of group 15 have compact or heavy plow layers and are hilly. Except for the stony land type, all are low in organic matter and available plant nutrients chiefly because they have been eroded. The stony land type is shallow to bedrock; the other soils are at least moderately deep to bedrock. In natural fertility the stony land type averages higher than the other soils, for little of it has been cropped and almost no accelerated erosion has taken place. All of the soils are moderately to strongly acid. Because of the compact surface soil, the strong slopes, stoniness, or combinations of these, the soils are poorly suited to crops. The plow layers have unfavorable tilth, and the low available moisture causes droughtiness during drier parts of the year.

Management requirements.—It is difficult to establish a good stand of permanent pasture on these soils. Tilth is poor, and a good seedbed is hard to prepare. After the seedbed is ready, erosion is a great hazard until the vegetation is well established. Low fertility and droughtiness make it difficult to get young growth started. Substantial quantities of phosphorus and lime and moderate supplies of potash and nitrogen are needed to establish the stand. Organic matter aids greatly in improving the seedbed. Growing of deep-rooted legumes will gradually improve the consistence and structure of the soils. It may be feasible to establish good pasture without special preparation of a seedbed; that is, by drilling the seed on stubbleland or a lightly harrowed land. In all field preparation, tillage should be done on the contour.

Areas that must be used for cultivated crops should be kept in long rotations that leave close-growing crops on the soils most of the time. A rotation consisting of a small grain followed by hay or pasture is the most feasible.

Strip cropping may be feasible on the longer slopes. Heavy fertilization is essential to good management, and so is the growing of deep-rooted legumes to increase the organic matter needed for improvement in tilth. The compact and heavy plow layer and strong slope make workability difficult; particular care is required to work the soils under optimum moisture conditions. When dry, the soils are extremely difficult to till, and they break into hard lumps difficult to pulverize. If tilled too moist, the soils form a plastic mass that dries or bakes to hard intractable clods.

Estimated acre yields for hay and pasture are given for soils of group 15 in table 20.

GROUP 16.—STONY SANDY SOILS OF LOW NATURAL FERTILITY NOT CONSIDERED WELL SUITED TO CROPS BUT SUITABLE FOR PASTURE

Extreme stoniness of several soils in group 16 and a combination of moderate stoniness, low fertility, strong slope, and erosion on the others make the entire group poorly suited to crops. All of these soils are well drained and permeable, but strongly acid, low in fertility, and usually low in organic matter.

Management requirements.—These soils are not so suitable for pasture as the more fertile silt loam soils, and a desirable vegetation mixture for grazing is more difficult to maintain. Where fertility has

TABLE 20.—*Estimated yields of hay and pasture on soils of management group 15, Cocke County, Tenn.*

[Yields in columns A to be expected under the level of management used by most farmers in the county; yields in columns B to be expected under better management. (See text discussion of management for soils of group 15.) Blank spaces indicate crop ordinarily is not grown on the soil or is not considered suitable for it. None of these soils are considered suitable for corn, wheat, oats, or tobacco.]

Soil	Lespedeza hay		Red clover		Permanent pasture	
	A	B	A	B	A	B
	Tons	*Tons*	*Tons*	*Tons*	*Cow-acre-days*	*Cow-acre-days*
Dunmore silty clay, severely eroded hilly phase	0.4	.9	------	1.2	25	70
Holston clay loam, severely eroded hilly phase	------	------	------	------	20	60
Jefferson-Dunmore complex, severely eroded hilly phases	------	------	------	------	25	65
Nolichucky clay loam, severely eroded hilly phase	------	------	------	------	20	55
Stony hilly land (Dunmore soil material)	------	------	------	------	25	60
Waynesboro clay loam, severely eroded hilly phase	.3	1.0	------	1.3	30	80

not been brought to a high level, such pasture plants as redtop, lespedeza, and fescue are suited. Bringing the fertility level to the point where the soils will support the more desirable grasses and legumes requires lime, nitrogen, phosphorus, and potash. Where properly inoculated legumes become established in the stand, nitrogen ordinarily is not required, but the pasture can be expected to respond to lime and fertilizers other than nitrogen applied at regular intervals. Mowing of weeds and excess growth is a greater problem than on the less stony smoother soils.

Small areas of these soils may be required for crops. Most of the common field crops are suited, but good yields require heavy fertilization. Because of the abundance of stones and strong slope, field operations are difficult. Light equipment or hand implements are necessary for cultivation and harvesting.

See table 21 for estimated acre yields of hay and pasture on soils of group 16.

GROUP 17.—HILLY AND STEEP SOILS SHALLOW TO SHALE OR SLATE

All of the soils of group 17 are hilly or steep and shallow to shale or slate bedrock. Shaly fragments occur throughout much of the soil material, which is predominantly silty and permeable. Natural fertility is moderately low, and the content of organic-matter is low. Much of the soil material is not very strongly acid, and there is some lime in much of the underlying rock. Much of the shale under the Dandridge soils is calcareous. The underlying shaly and slaty mate-

TABLE 21.—*Estimated acre yields of hay and pasture on soils of management group 16, Cocke County, Tenn.*

[Yields in columns A to be expected under the management used by most farmers in the county; yields in columns B to be expected under better management. (See text discussion of management for soils of group 16.) Blank spaces indicate crop ordinarily is not grown on the soil or is not considered suitable for it. None of these soils are considered suitable for corn, wheat, oats, red clover or tobacco.]

Soil	Lespedeza hay		Permanent pasture	
	A	B	A	B
	Tons	*Tons*	*Cow-acre-days*	*Cow-acre-days*
Holston cobbly loam:				
Hilly phase			25	70
Eroded hilly phase			25	65
Jefferson stony sandy loam:				
Hilly phase		0.8	25	70
Eroded hilly phase		8	25	65
Jefferson stony sandy clay loam, severely eroded hilly phase			20	55
Jefferson very stony sandy loam:				
Rolling phase			30	65
Eroded rolling phase			25	60
Hilly phase			25	55
Eroded hilly phase			25	50
Steep phase				50
Eroded steep phase			25	50
Ramsey stony fine sandy loam, hilly phase				50
Stony colluvium (Jefferson soil material)			20	50

rial in most places can be disrupted by heavy tillage implements. Available moisture is low, and the south-facing more eroded areas are particularly droughty.

Management requirements.—Low fertility, limited moisture supply, and susceptibility to erosion make these soils poorly suited to crops requiring cultivation. Under good management they are well suited to permanent pasture, but the more droughty areas have a limited grazing period. On cleared areas not greatly depleted of their natural fertility, bluegrass and white clover are common. Phosphorus is the chief fertilizer needed, though lime applied in moderate quantities would benefit many areas. Tests should be made to determine deficiency in lime. An initial application of potash and some nitrogen would likely be beneficial; but after a good pasture stand has been established neither may be needed. Barnyard manure is valuable for improving productivity. If manure is not available for eroded places, it may be a good practice to grow sericea lespedeza, sweetclover, or other deep-rooted legumes to be turned under.

Subsoiling on the contour to depths of 15 or 20 inches is beneficial where the underlying shale or slate is easily broken loose. This improves permeability to roots and moisture and thereby increases the availability of plant nutrients and the water-holding capacity. Proper

fertilization and removal of brush and weeds greatly aid in maintaining pasture of high quality.

Areas needed for tilled crops require very careful management. Cultivation should be minimized by using long rotations made up chiefly of close-growing crops. A rotation consisting of a fall-sown small grain followed by hay and pasture is the most suitable. Fertility should be maintained at a high level, for this is usually necessary to maintain a vigorous protecting cover and to obtain fairly good yields. All field operations should be done on the contour, and in many places strip cropping may be feasible.

See table 22 for estimated average yields of hay and pasture on soils of management group 17.

TABLE 22.—*Estimated average yields of hay and pasture on soils of management group 17, Cocke County, Tenn.*

[Yields in columns A to be expected under the level of management used by most farmers in the county; yields in columns B to be expected under better management. (See text discussion of management for soils of group 15.) Blank spaces indicate crop ordinarily is not grown on the soil or is not considered suitable for it. None of these soils are considered suitable for corn, wheat, oats, red clover, or tobacco.]

Soil	Lespedeza hay		Permanent pasture	
	A	B	A	B
	Tons	*Tons*	*Cow-acre-days*	*Cow-acre-days*
Dandridge silt loam:				
Steep phase			40	70
Hilly phase	0.4	0.8	30	75
Dandridge shaly silt loam:				
Eroded steep phase			30	70
Eroded hilly phase	.4	.6	30	75
Dandridge and Litz silt loams:				
Steep phases			30	60
Hilly phases			30	65
Dandridge and Litz shaly silt loams:				
Eroded steep phases			20	60
Eroded hilly phases			30	65
Litz shaly silt loam:				
Steep phase			20	60
Eroded hilly phase			25	70
Ramsey shaly silt loam:				
Steep phase			25	50
Eroded steep phase			20	45
Hilly phase			30	75
Eroded hilly phase			30	70
Teas silt loam, hilly phase			25	60

GROUP 18.—NEARLY LEVEL POORLY DRAINED GRAY SOILS

The soils of group 18 are poorly suited to crops but fair to good for pasture. They occur in poorly drained nearly level to slightly depressed areas. The Prader and Wehadkee soils are on stream bottoms subject to flooding; the Tyler soil is on stream terraces. The Tyler soil is low in fertility, whereas the Prader and Wehadkee vary

considerably in that respect. The Wehadkee and Tyler soils are strongly acid. Much of the Prader is neutral to slightly alkaline.

Under natural drainage these soils are poorly suited to cultivated crops. They are considered suitable for pasture, though the Tyler soil is low in productivity. The soils can be improved by artificial drainage and would be suitable for cultivated crops if adequately drained. Draining the Tyler soil, however, is difficult and of doubtful practicability.

Management requirements.—Under natural conditions these soils furnish pasture of fair quantity but poor to fair quality all through the grazing season. The first step in pasture improvement should be bettering the drainage. In most places much can be done by open ditches, bedding, and diversions. Tiling probably would be effective on the Prader and Wehadkee soils, but on the Tyler soil, because of the claypan, it might not be advisable. After drainage has been improved, seedings of bluegrass, white clover, redtop, and lespedeza can be expected to do fairly well, if lime, phosphate, and potash are used where needed. Redtop and lespedeza may be grown with some success without amendments, but the pastures are of lower quality. Weeds should be controlled by grazing and mowing.

Although poorly suited to crops requiring tillage, these soils may be fairly well suited to sorghum, soybeans, and other crops that can be planted late in spring or early in summer and harvested in fall. If these soils are effectively drained, use and management will be similar to that for the imperfectly drained soils of group 1. Crop yields, however, would not be expected to be as high, especially on the Tyler soil.

Estimated average yields of corn, hay, and pasture on soils of management group 18 are given in table 23.

GROUP 19.—SOILS POORLY SUITED TO EITHER CROPS OR PASTURE BUT ADAPTED TO FORESTRY

The soils of group 19 have one or a combination of undesirable characteristics that largely preclude their use for either crops or pasture. All are low in fertility, and many are stony, shallow to bedrock, or limited in water-holding capacity.

About 90 percent of the acreage is in native cut-over forest; the rest was cleared at one time. Some of the cleared acreage has reforested naturally, and a few small areas have been planted. Much of the acreage now cleared is in unimproved pasture; the small remaining part is cropped, chiefly to corn. Yields are small, and in most places the soil is deteriorating under cultivation. The soils of this group are the following:

Ash loam, steep phase
Dandridge silt loam, very steep phase
Dandridge and Litz silt loams, very steep phases
Dunmore silty clay, severely eroded steep phase
Gullied land:
  Dandridge soil material
  Dunmore soil material
Jefferson stony sandy loam, eroded steep phase
Ramsey shaly silt loam, very steep phase
Ramsey stony fine sandy loam:
  Steep phase
  Eroded steep phase
Riverwash
Rock land (limestone)
Rough mountainous land (Ramsey soil material)
Stony rough land (Ashe soil material)
Stony steep land (Dunmore soil material)
Teas silt loam, steep phase
Teas shaly silty clay loam, eroded steep phase

TABLE 23.—*Estimated average yields of corn, hay, and pasture on soils of management group 18, Cocke County, Tenn.*

[Yields in columns A to be expected under the level of management used by most farmers in the county; yields in columns B to be expected under better management. (See text discussion for soils of group 18.) None of these soils in their natural state of drainage are considered suitable for corn, wheat, oats, red clover, or tobacco.]

Soil	Corn		Lespedeza hay		Permanent pasture	
	A	B	A	B	A	B
	Bu.	*Bu.*	*Tons*	*Tons*	*Cow-acre-days*	*Cow-acre-days*
Prader silt loam [1]	------	33	0.6	1.2	40	110
Tyler silt loam [1]	------	30	.5	1.0	40	90
Wehadkee silt loam [1]	------	35	.7	1.3	40	110

[1] Yields in columns A to be expected without artificial drainage; those in columns B, with adequate drainage.

Management requirements.—The unfavorable characteristics of the soils in group 19 limit their suitability to forest. The more desirable areas that occur on farms where there is a great need for pasture or crop acreage may be used for these purposes. When used for crops, management is very exacting and yields are seldom high. Maintaining fertility and adequate moisture for plants, restraining runoff, and carrying on field operations are among the difficult problems involved in using these soils for crops.

FORESTS [8]

Forests covered practically all of Cocke County before settlement by white people. Now, approximately 58 percent of the land is forested, and of this 43 percent is farm woodland, 24 percent private nonfarm forest, and 33 percent public forest.[9] Of the 54,493 acres in Federal ownership, 37,864 acres is a part of the Cherokee National Forest and the rest is in the Great Smoky Mountains National Park. Based on the number of farms reporting in the 1950 census, the average area of woodland on farms is 31 acres.

FOREST GROWTH BY SOIL ASSOCIATION AREAS

Forest growth varies with the soils. A great part of the mountainous sections of the county is under forest. The most extensive forested areas in the valley section are in the Steep Dandridge-Whitesburg-Hamblen soil association. The steeply sloping and shallow soils caused pronounced differences in native vegetation on the different exposures, or aspects. Moisture-loving species such a basswood, yellow-

[8] Prepared by G. B. Shivery, extension forester, University of Tennessee.
[9] 1945–46 Appraisal, State Department of Conservation and American Forestry Association.

poplar, Northern red oak, beech, and white ash dominate on lower north- and east-facing slopes of the narrow ravines. White hickory and scarlet and black oaks are on the upper slopes, and chestnut oak is conspicuous on the ridge tops. On the drier southern and western exposures, Virginia pine makes up pure stands in places. The rest of the forest on these drier sites includes chestnut and scarlet oaks and sourwood on the upper slopes, and Southern red and post oaks and dogwood on the lower slopes.

The cut-over native forest on the adjacent Dandridge-Leadvale-Hamblen soil association includes three forest types—upland hardwoods, cedar-hardwoods, and yellow pine-hardwoods. Common species in the ravines or moist sites are scalybark hickory, white, post, black, and Northern red oaks, white hickory, black walnut, white ash, and white elm. On the drier sites, black, scarlet, white and post oaks, redbud, Virginia pine, redcedar, scalybark hickory, and a few shortleaf pine predominate. Virginia pine or redcedar may be outstanding conifers in some of the drier places.

A great part of the Waynesboro-Nolichucky-Dunmore soil association is cleared. The native forest on the rest consists of post, black, scarlet, white, and Southern red oaks, white hickory, Virginia pine, blackgum, sweetgum, and red maple. Native forest on the Holston-Nolichucky-Dandridge soil association is confined chiefly to the Dandridge soils, and the forest cover is similar to that for the Waynesboro-Nolichucky-Dunmore soil association, except that Virginia pine is more common and there is some redcedar.

Native forest in the Dunmore-Greendale soil association areas is confined chiefly to the stronger slopes. The yellow pine-hardwoods forest type makes up a great part of the woodland. This type consists of yellow pines and hardwoods, the pines making up 25 to 75 percent of the total dominant and co-dominant stems. Virginia pine and individual specimens of shortleaf pine are intermixed with such hardwoods as yellow locust, yellow-poplar, black, scarlet, and white oaks, dogwood, black walnut, and sassafras. The addition of hemlock is indicative of the cooler, more humid climate near the mountains.

Most of the Holston and many of the Monongahela soil areas in the Holston-Monongahela-Tyler soil associaton are cleared. Much of the Tyler soil is under native forest. It has a distinctive forest growth consisting of willow oak, red maple, sweetgum, white elm, white ash, and sycamore. The native forest on the better drained soils, such as the Holston, consists of the common upland hardwoods, sometimes with shortleaf pines and an occasional pitch pine.

Several forest types are on the phases of Ramsey shaly silt loam and the stony lands. Variation in steepness and direction of slope and in elevation cause differences in forest type. The yellow pine-hardwoods type is the most extensive. It occupies the drier sites and consists of Virginia and pitch pines mixed with chestnut, scarlet, black, and blackjack oaks, red maple, blackgum, and hickories. The understory includes mountain-laurel, smilax briers, blueberries, huckleberries, New Jersey tea, and azaleas. Upland hardwoods, white pine-hardwoods, and hemlock-hardwoods forest types occur in coves and on the cooler, more moist slopes. The upland-hardwoods type consists of yellow-poplar and basswood, with hemlock, yellow and black birches, red maple, cucumber magnolia, blackgum, yellow buckeye, black cherry, scarlet oak, yellow locust, white ash, hop horn-

beam, hickories, mountain maple, Hercules-club, and rhododendron. In the white pine-hardwoods forest type, white pine predominates in various mixtures of yellow-poplar, Northern red, white, scarlet, and chestnut oaks, black birch, red maple, and black cherry. The hemlock-hardwoods forest type consists predominantly of Eastern hemlock in association with beech, sugar maple, yellow and black birches, black cherry, white ash, Northern red oak, and yellow buckeye.

The forest types on the Jefferson-Allen-Barbourville soil association vary a great deal. That part of the association along the base of the high north-facing mountainous tract south of Cosby is occupied by the upland-hardwoods forest type, whereas areas adjacent to Stone and Meadow Creek Mountains are under yellow pine-hardwoods forest.

Mixed native forest occupies very nearly all of the Ramsey (sandy)-Stony land soil association. This association area is distinguished by its ruggedness and high elevation. Yellow pine-hardwoods, upland hardwoods, and oak-chestnut forest types prevail. There is much Table-mountain pine. Pitch pine occurs at higher elevations, and there is less Virginia pine in the yellow pine-hardwoods forest type occurring on this association. Key species for the oak-chestnut type are various oaks and dead chestnut and chestnut sprouts, with hickories, pitch or Table-mountain pines, Virginia pine, yellow locust, sourwood, dogwood, blackgum, black birch, and red maple. The understory of the oak-chestnut forest type is similar to that described for the yellow pine-hardwoods type on the Ramsey (silt loam)-Hamblen soil association.

The Stony land-Ashe soil association has a variety of forest types on it because of differences in elevation and exposure. Upland hardwoods, oak-chestnut, and yellow pine-hardwoods forest types are represented.

Additional forest types.—Within the boundaries of the Great Smoky Mountain National Park three additional forest types are represented—hemlock, northern hardwoods, and spruce-fir. The spectacular spruce-fir is on the crest of the Great Smoky Mountains in the vicinity of Mount Cammerer (White Rock). Fraser fir and red spruce give name to this forest type. Associated with this type is Heath Bald, which has a cover of mountain-laurel, *Rhododendron catawbiense*, along with highbrush blueberry, smilax, briers, red twig, leucothoe, and scattered red spruce, Fraser fir, yellow birch, and mountain ash. The spruce-fir forest type merges into the northern hardwoods at the heads of coves, and on cold slopes and benches facing north. Key species are sugar maple, beech, and yellow birch. The hemlock forest type is on spur ridges at elevations between 3,100 and 4,700 feet.

FOREST RESOURCES

In 1941, exclusive of the area included in the National Park, which is noncommercial, 19 percent of the timber-producing areas were upland hardwoods, 10 percent oak-chestnut, 2 percent yellow pines, 2 percent hemlock-hardwoods, 9 percent white pine-hardwoods, 56 percent yellow pine-hardwoods, and 2 percent cedar-hardwoods. As a further indication of the size and stage of development of the timber resources of the county, 39 percent of this area was classified as saw timber, 39 percent as cordwood, and 22 percent as below cordwood.

The saw timber volume totaled 125,825 M board feet, of which 77,768 M board feet was hardwoods and 48,057 M board feet was softwoods. The average volume per acre amounted to 774 board feet, and the total growth per acre per year was 130 board feet.[10]

The chief forest products obtained in this county are lumber, pulpwood, and chestnut extract wood. Production is given for stated years in table 24.

TABLE 24.—*Production of forest products in Cocke County, Tenn., for stated years*

[All data from the Southern and Southeastern Forest Experiment Stations]

Product	1941	1942	1946	1947	1948
Softwood lumber--M board feet--	(1)	3, 105	5, 464	(1)	(1)
Hardwood lumber-------do----	(1)	2, 962	6, 676	(1)	(1)
Pine pulpwood---------cords--	3, 700	(1)	(1)	2, 884	5, 555
Hardwood pulpwood-----do----	6, 200	(1)	(1)	1, 116	1, 716
Chestnut extract wood---do----	9, 500	(1)	(1)	10, 064	10, 383

[1] Not available.

FOREST MANAGEMENT

A radical change in forest management will be required to halt progressive deterioration of forest resources in this county. The direct benefit of improved management will become apparent in bigger yields of better quality timber. The indirect benefits, frequently overlooked, are worth special mention.

A protective layer of forest litter absorbs the impact of rain and preserves the tiny pores and channels between soil particles through which water moves downward. Fungi, bacteria, and tiny animals consume forest litter and each other, and eventually a dark-brown colloidal substance called humus is formed. Humus carried downward into the mineral soil by percolating water improves both physical structure and fertility. The litter and humus, in addition, have great capacity to absorb water directly. Porosity of the soil is further increased by the channels left after the decay of dead roots. The soil-binding function of the surface roots is highly beneficial. The densest network of roots is in the lower part of well-developed layers of litter.

Results obtained at the erosion station near Statesville, N. C., show that only 0.001 ton an acre of soil and 0.06 percent of rainfall were lost from virgin woodland (*11*). A companion plot, burned twice yearly, showed runoff of 11.5 percent and soil loss of 3.08 tons an acre.

Similar experiments were made at Zanesville, Ohio, for a 9-year period on cultivated land, pasture, and woodland (*12*). Runoff was 20.6 percent on cultivated land, 13.8 percent on pasture, and 3.2 percent on woodland. The loss of soil an acre was 17.18 tons on cultivated land, 0.10 ton on pasture, and 0.01 ton on woodland. These experiments show that erosion control and moisture absorption are maximum under complete forest cover. Where the cover is properly maintained, soils forested with second growth do not lose their porosity unless they are overgrazed or the litter is destroyed by fire (*1*).

[10] See footnote 9, p. 132.

MANAGEMENT PRACTICES

Forest management practices can be placed in four major groups: (1) protection from fires, (2) protection from overgrazing, (3) use of proper cutting methods, and (4) planting where volunteer seeding of desirable species does not occur.

FIRE PROTECTION

The mobile-crew system of organized fire protection, with county participation, became effective in April 1947. The mobile crews, five men in each, are under the direction of the State Division of Forestry. The crews are on duty when the fire hazard is greatest, normally 3 months in spring and 2 months in fall.

Three fire crews work in this county. The first, stationed on Bogard Creek in the Cosby section, maintains contact with a State-owned 60-foot steel tower on English Mountain. The second, in the Del Rio section, has direct communication with the Hall Top tower on Stone Mountain. The 60-foot State-owned tower on Hall Top is on private land inside the national forest. It is used to protect both national and private forest lands, and the U. S. Forest Service provides the lookout man. A third mobile crew, stationed at Parrottsville, is in communication with the U. S. Forest Service fire tower on Meadow Creek Mountain, near the Greene County line. Another Forest Service tower is on Round Mountain near the North Carolina line. The Hall Top and Round Mountain fire towers maintain radio communication with U. S. Park Service towers such as those on Greenbrier Pinnacle and Mount Cammerer.

The closely knit fire protection system now operating in the county will forestall dangerous and damaging fires only if every individual cooperates. Danger is especially great during dry weather. Most forest fires are caused by carelessness in burning brush, but smokers, incendiarism, lumbering operations, and railroads are contributing causes. Complete fire control is necessary to produce satisfactory forest, protect scenic values, and maintain the soil porosity that checks erosion.

CONTROL OF GRAZING

Control of grazing is a necessary part of forest management. Under woodland grazing, livestock repeatedly browse and eventually destroy the young growth needed for regeneration of the stand. Also, the animals disturb the humus and pack down the soil. As a result, less water is absorbed and danger of erosion increases. Woodland grazing, furthermore, may be unprofitable purely in terms of livestock production. Indiana experiments show that woodland grazing at intensities of 2, 4, or 6 acres per animal unit, without supplemental feeding, results in serious deterioration of the livestock over a 6-month season (*3*).

CUTTING PRACTICES

Proper harvesting involves removal of culls and weed trees [11] to give straight, tall, well-crowned trees free of defect a chance to grow to timber size more rapidly. On farm woodland, the culls and weed trees can be used for fuel or pulpwood. After woodland has been cleared of

[11] Culls are trees of commercial species that are unsound, crooked, short, bushy topped, or slow growing; weed trees are species having no commercial value.

culls and weed trees, selective cutting should be practiced; that is, the trees should be cut as they mature, not the whole stand at one time. The trees cut should be removed in such a way that damage to those left is kept at a minimum.

Cutting practices now used in the county could be much improved. More emphasis needs to be placed on the type of cutting suggested, as it will lead to sustained yields of better quality timber.

PLANTING

Planting is recommended for those areas that will not reforest through natural, or volunteer, reseeding. If seed trees are nearby and the soil is in a condition favorable for germination and survival, planting is not required. Virginia pine, a prolific producer of seed, is able to grow on dry and otherwise less favorable sites. Shortleaf pine usually reseeds successfully only on the more productive soils at lower elevations. At higher elevations, the natural reseeding usually consists of pitch pine.

Planting involves considerable advance planning. A species suited to the soil, exposure, and elevation should be selected. Pine is usually best able to withstand the severe growing conditions that will be encountered on land that needs to be planted. Shortleaf pine is considered most desirable for eroded phases of the Dunmore, Jefferson, Dandridge, and Holston soils. White pine is suitable for north- and east-facing slopes and ravines with good depth to bedrock and comparatively low elevation. Dry sites at higher elevations are better suited to pitch pine than Virginia pine. Yellow-poplar seedlings require cool, moist situations at moderate elevation—north- and east-facing slopes and ravines, hollows, and coves where the soil is deep and fertile. Black locust is not recommended for separate planting. It can be used in mixed plantings or where well-aerated soil material has accumulated, as behind check dams in gullies. Durable yellow locust for fence posts usually can be obtained from the forested ridges and mountainsides, so plantings of black locust are not urgently needed.

Some advance preparation is usually required before planting. Each site presents specific problems, but breaking and mulching of galled areas, building low check dams of brush in gullies, and plowing contour furrows are frequently involved. Forest seedlings of suitable species can be obtained without cost from the Tennessee Valley Authority through the county agricultural agent. The chief species used for replanting is shortleaf pine, but some white pine, black locust and pitch pine are also used.

INTERPRETATIVE GROUPINGS

After an area has been mapped and the data on soils has been recorded, a number of useful soil groupings can be made. For example, soils can be grouped by lime requirement, degree of fertility, drainage, degree of slope, or stoniness. The soils of this county are grouped by management requirements in the section on Use and Management of Soils. Two additional groupings are presented in this section.

SOIL ASSOCIATIONS

Soils occur not only in characteristic postions but also in characteristic geographic association with other soils. Dandridge soils, for

example, occur on shaly ridges in a hilly to steep landscape and are associated with narrow strips of Whitesburg and Hamblen soils. Likewise, Emory soils occur on alluvium along gentle drainageways generally in association with Dunmore and Dewey soils. Soils of one or more different series occurring in more or less regular pattern are called a soil association. The soils in an association may be similar in or very unlike in characteristics, but there is a certain unformity, or pattern, in the way they occur.

The association in which a soil occurs commonly influences greatly its present use, potential use, and the relative agricultural importance. For example, a soil physically well suited to corn and other crops may or may not be used for them, depending on whether or not it is associated with soils poorly suited to those crops.

Thus, if a soil survey is to be used to best advantage, it is not enough to know only the characteristics, distribution, and extent of the separate soils, their suitability for various uses, and their management requirements. One should also know the association, or the geographic soil group, in which they occur. Such information is valuable in understanding the distribution of the soils, interpreting their present use, and planning their future use.

Fourteen distinct soil associations have been recognized in Cocke County, as shown in figure 2. A brief description of each association follows. More detailed knowledge of these associations can be obtained by studying the detailed soil map, the descriptions of the soils given in this report, and the association map (fig. 2).

CONGAREE-STATE AND STASER-SEQUATCHIE SOIL ASSOCIATION

The Congaree-State and Staser-Sequatchie soil association occupies bottom lands and low stream terraces along larger streams. The Congaree, State, and associated soils occupy the areas containing much micaceous material originating from granite, gneiss, or schist along the Nolichucky, French Broad, and Pigeon Rivers. Much smaller in acreage are the Staser, Sequatchie, and associated soils, which consist predominantly of material originating from shale, slate, and sandstone or quartzite rocks and occur in the valleys of Cosby and Trail Fork Big Creeks. The entire association covers about 3.5 percent of the county.

The topography of the association is nearly level to undulating. Approximately half is on bottom lands subject to overflow, and the rest on gently undulating low stream terraces. Most of the acreage is well drained. Nevertheless, significant areas are imperfectly to poorly drained, and strips of sandy Buncombe soil along the river channels are excessively drained. Excepting the Buncombe soil, general fertility is moderate to high and moisture relations, aside from flooding, are favorable for plants.

Most areas are cleared and, with the exception of the Wehadkee soil and part of the Buncombe soil, are intensively used for row crops. Corn predominates, but truck crops, tobacco, and hay are also common. Some small grain is grown on the low stream terraces. Yields are high. Most of the soils are on farms that consist dominantly of more sloping upland soils much less suited to intensive use.

This association is made up largely of some of the most desirable soils in the county for intensive cropping. Most of it is very produc-

FIGURE 2.—Soil associations in Cocke County, Tenn.

tive, well suited to high-value crops, and easily worked and conserved. Heavier fertilization and more intensive use of this association on many farms, along with less intensive use of the adjacent soils of the upland, is a general aim to improve soil management.

HOLSTON-MONONGAHELA-TYLER SOIL ASSOCIATION

The Holston-Monongahela-Tyler soil association occupies nearly level to rolling moderately high stream terraces (pl. 4, *B*). The soils generally are low in fertility and organic matter and very poorly to moderately well drained. The less well-drained acreage has compact

subsoil. The aggregate area, about 3.0 percent of the county, occurs in the northwestern quarter of the county in the valleys of the Nolichucky and French Broad Rivers.

Much of the acreage is cleared, except for parts of some of the larger very poorly drained areas. General livestock farming prevails. Corn, hay, and small grains are the chief crops. Yields are high only on some of the better drained soils farmed under a high level of management.

The smooth surface favors these soils, but productivity and range of suitability for crops are limited by the low fertility and poor drainage of much of the acreage. Soybeans, grasses, and some legumes for hay and pasture and small grains are among the better suited crops. The best drained areas are fairly well suited to corn, some truck crops, and the more exacting legumes if adequately fertilized.

HOLSTON-NOLICHUCKY-DANDRIDGE SOIL ASSOCIATION

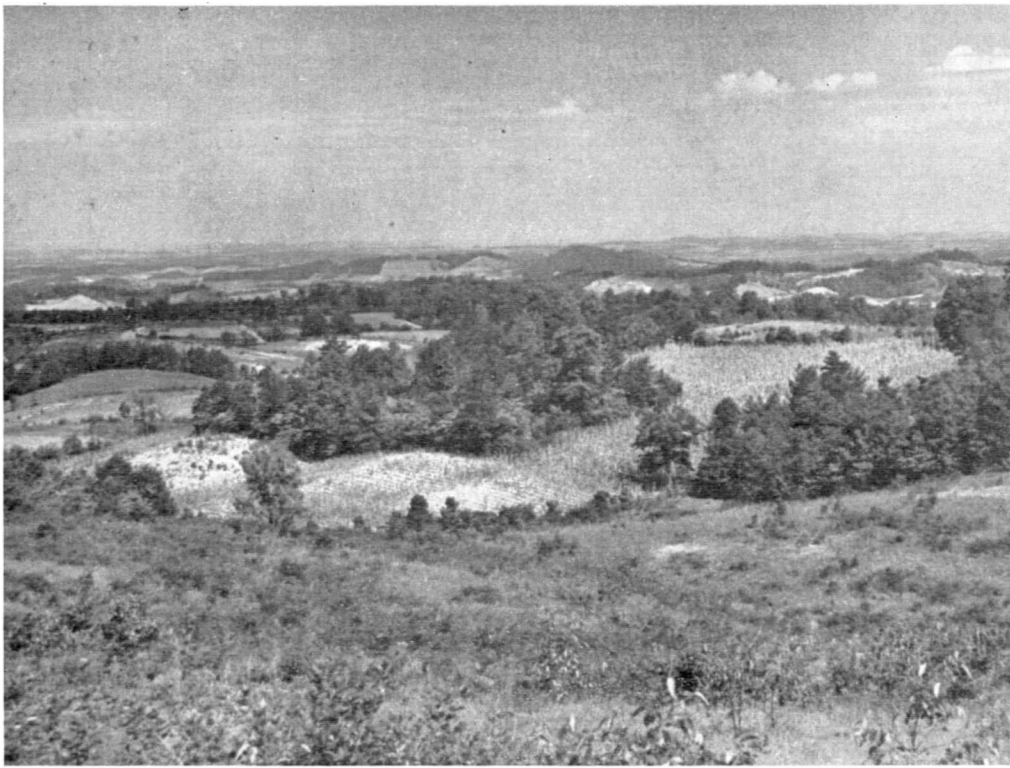
Soils of the Holston-Nolichucky-Dandridge soil association occupy high stream terraces. The areas are deeply dissected by a drainage system that causes variable topography and exposes the calcareous shale. The smoother, undulating to rolling ridge tops are occupied by the Holston and Nolichucky soils; and the predominantly hilly ridge slopes, chiefly by Dandridge soils (pl. 5). Fertility and organic-matter content are low. The soils derived from stream-terrace material are moderately to strongly acid, whereas the Dandridge soils are predominantly slightly acid or alkaline. Areas on the ridge tops are moderately well to well drained, but a few places have poor drainage. Drainage on ridge slopes is excessive, and much of the cleared acreage has been damaged by erosion. This association occupies about 1.5 percent of the county; all of it is in the northern part between the Nolichucky and French Broad Rivers.

Most of the undulating and rolling ridge tops have been cleared and are now used for general farm crops, chiefly corn, small grains, lespedeza for hay, and tobacco. Some areas of the Dandridge soils are in cut-over forest, many are used for unimproved pasture, some are idle, and a few are cropped. Crop yields in general are moderately low unless a high level of management is practiced. Tobacco produces fairly high yields if rather heavily fertilized.

This soil association is fairly well suited to general livestock farming. The strong slopes and shallowness of the Dandridge soils greatly limit their use for crops, but they are capable of supporting fairly good pasture if properly managed. Many areas can be made to support a good cover of orchard grass, bluegrass, ladino and white clovers, or similar plants. The soils on the undulating and rolling ridge tops are fairly productive of most general farm crops but require substantial use of fertilizer, addition of lime and organic matter, and use of moderate to long rotations. Small areas on the smoother parts are suitable for intensive use if adequately fertilized.

WAYNESBORO-NOLICHUCKY-DUNMORE SOIL ASSOCIATION

The Waynesboro-Nolichucky-Dunmore soil association occupies undulating to hilly high stream terraces. It differs from the Holston-Nolichucky-Dandridge soil association in being somewhat less rolling or hilly, in having a higher level of fertility and better drainage, and



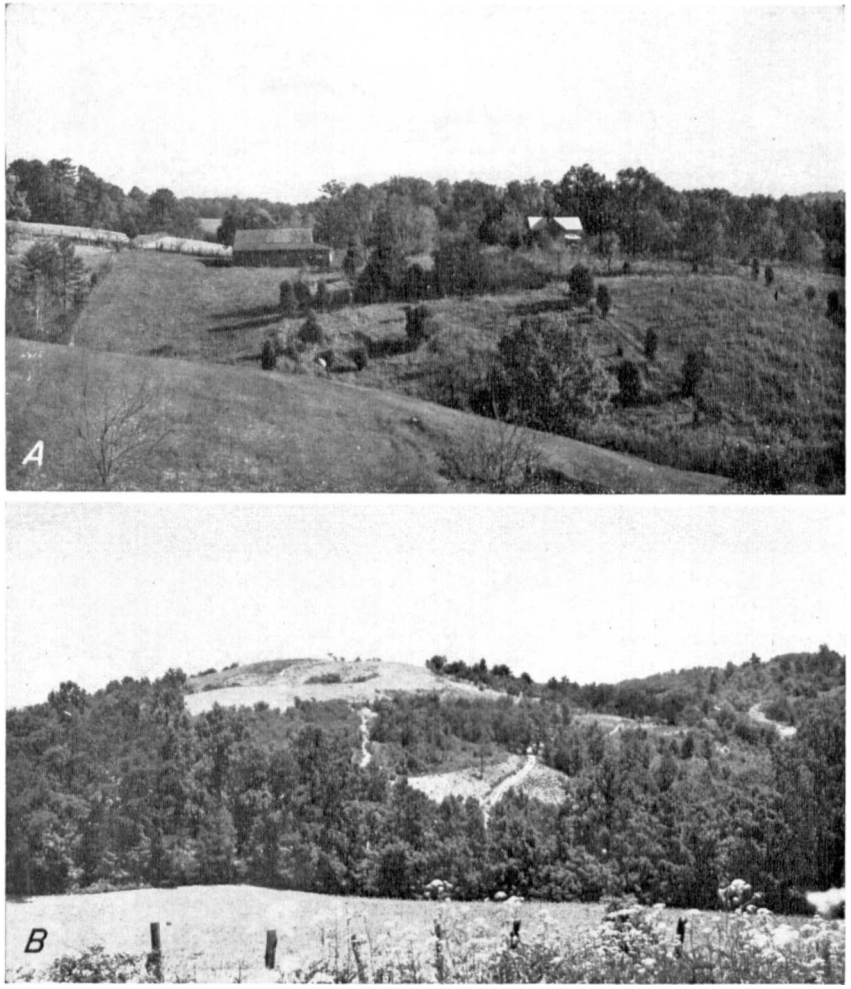
Landscape of Holston-Nolichucky-Dandridge soil association. In general, cleared areas are H areas along draws are Dandridge soils.

A, View of Dunmore-Greendale soil association showing the rolling to hilly relief and one of the sinkholes common to these soils.

B, A farm in the Dunmore-Greendale soil association that has a considerable acreage of the smooth fertile Greendale and Lindside soils well suited to moderately short rotations.

All photos by courtesy of Tennessee Valley Authority.

A, Prosperous farm consisting chiefly of Dunmore and Greendale soils. Pasture, hay, and small grains predominate on this farm; the small acreage of row crops is confined chiefly to the smooth soils well suited to intensive use.
B, Corn and unimproved pasture on Dunmore and Greendale soils.
All photos by courtesy of Tennessee Valley Authority.



A, Hilly areas of the Groseclose-Greendale soil association suited to general farming.

B, View of predominantly hilly upland part of the Dandridge-Leadvale-Hamblen soil association showing the narrow rolling ridge tops and some steep areas on slopes.

All photos by courtesy of Tennessee Valley Authority.

in overlying limestone in most places. The stronger slopes are occupied chiefly by Dunmore soils, whereas the stronger slopes in the Holston-Nolichucky-Dandridge soil association are occupied by Dandridge soils. The soils generally are moderate to high in fertility, and the acreage of poorly drained soils is very small. The aggregate area, about 3.5 percent of the county, is mostly in the vicinity of Newport along the French Broad and Pigeon Rivers.

Much of this association has been cleared and is now used for crops or pasture. General livestock raising, supplemented by tobacco growing, is the chief type of farming. Corn, tobacco, small grains, and various legumes and grasses for hay and pasture are the most common crops. The use of fertilizers is common, and crop yields are moderately high. Some of the stronger slopes are still in deciduous cut-over forest, but parts have been badly eroded and are in a low state of productivity or are lying idle.

This association includes some of the more desirable soils of the county for crops. Relatively smooth surface, good tilth, adequate drainage, and desirable response to good management, favor most of the soils for crop and pasture use.

DEWEY-DUNMORE SOIL ASSOCIATION

The Dewey-Dunmore soil association occupies only about 0.5 percent of the county. It occurs on undulating to rolling uplands over limestone and represents the browner, more fertile soils of the county. The predominant Dewey soils are distinguished by their brown surface soil, good tilth, permeability, and high fertility. The Dunmore soils, somewhat less extensive than the Dewey and lower in fertility and more permeable, are nevertheless productive soils. Strips of Greendale soils are common along the drainways.

Practically all of this association has been cleared and is now used for crops or pasture. General livestock farming, supplemented by small acreages of tobacco grown as a cash crop, is the prevailing type of agriculture. Corn, small grains, red clover, and alfalfa are the most common field crops. Yields are fairly high on the Dewey, Greendale, Emory, and some of the Dunmore soils. Many of the Dunmore soils, however, have been greatly eroded and therefore have lost a notable part of the original fertility.

This association consists of some of the most desirable soils in the county for general farming. Under a high level of management, the soils are easily kept highly productive. The smoother parts have a wide range of suitability for crops and pasture and are not difficult to maintain if a moderately long rotation is used. The more sloping Dunmore soils have a more limited range of suitability for crops and usually require long rotations.

DUNMORE-GREENDALE SOIL ASSOCIATION

Much of the undulating to hilly part of the county over limestone is in the Dunmore-Greendale soil association (pl. 6, *A*). Dunmore soils predominate; limited areas of Greendale and Lindside soils occur along the draws and creeks (pl. 6, *B*). The association generally is less fertile than the Dewey-Dunmore soil association. Drainage conditions are good, but percolation is somewhat slower in the firmer subsoil of the Dunmore soils. The areas consist of moderately broad

undulating and rolling ridges with hilly or steep slopes and smoother or nearly level narrow strips along the drainways. Areas of stony land occur in some sections. This extensive soil association covers about 11.5 percent of the county. The largest area extends in a northeast-southwest direction across the central part.

Approximately 80 percent of the association has been cleared and is used for crops or pasture (pl. 7, *A*). General livestock farming, supplemented by tobacco as a cash crop, is the prevailing type of agriculture. Corn (pl. 7, *B*) tobacco, small grains, and a wide variety of legumes and grasses for hay and pasture are the chief crops. Yields vary widely but are usually higher than those produced in the Holston-Nolichucky-Dandridge and the Danridge-Leadvale-Hamblen soil associations and lower than those in the Waynesboro-Nolichucky-Dunmore soil association.

This association is well suited to general livestock farming. It is capable of producing high yields of the more desirable legumes and grasses, providing management that will maintain fairly high fertility is followed. Because of the firm subsoil in the Dunmore soils and the rolling and hilly relief, this association is less well suited to intensive cultivation than some of the associations in which smoother, more permeable soils predominate. Systems of farming in which small grains and legumes and grasses predominate are well suited.

GROSECLOSE-GREENDALE SOIL ASSOCIATION

The Groseclose-Greendale soil association occupies a rolling to hilly landscape (pl. 8, *A*) underlain by shaly limestone in the eastern part of the county. It covers about 1 percent of the county. The Groseclose soils greatly predominate; the Greendale soils are limited to narrow strips along the drainways. In general, fertility is low, and the subsoil is compact and slowly permeable. Much of the acreage has been cleared, and erosion has been active on most areas. General farming similar to that on the Dunmore-Greendale soil association prevails, but the soils of this association are generally less well suited to the more exacting legumes and row crops. Most parts require moderately long rotations consisting predominantly of small grains and grasses and legumes. The acreage well suited to intensive use for tobacco and truck crops is limited chiefly to Greendale soils.

DANDRIDGE-LEADVALE-HAMBLEN SOIL ASSOCIATION

The Dandridge-Leadvale-Hamblen soil association occupies a great part of the shale belt in the northern third of the county north of Newport. The aggregate area is about 12 percent of the county. The landscape (pl. 8, *B*) is predominantly hilly. It consists of narrow rolling ridge tops flanked by hilly to steep slopes and smoother rather narrow valleys occupied chiefly by soils of the bottom land. The soils of the upland part are usually low in fertility and shallow to calcareous shale bedrock; those on the alluvium of the valley floors are moderately fertile, deep, but somewhat variable in drainage.

From 70 to 85 percent of the area has been cleared. Most of the remaining acreage is confined to the steepest slopes and is forested. Practically all of the cleared upland area has been eroded considerably and is either idle or used as unimproved pasture. General livestock

farming prevails. Small grains, hay, and corn are the chief crops on the hilly Dandridge soils, and yields are low. The narrow strips of soils (Hamblen and Whitesburg) on alluvium along the drainways and streams are used intensively; corn is the predominant crop, and yields are fairly high. Pasture varies in quantity. Where the Dandridge soils have been fertilized, fairly good stands of bluegrass and white clover are common. Farms in general are not so prosperous as those within the Dunmore-Greendale, Dewey-Dunmore, and Waynesboro-Nolichucky-Dunmore soil associations.

In general, the soils of this association cannot be well suited to systems of farming that require keeping much of the acreage in cultivated crops. They are capable of supporting a livestock system where considerable use can be made of permanent pasture, where requirements for row crops can be met by heavy fertilization, and where high yields are obtained on the limited acreage of Hamblen and Whitesburg soils. Most of the Dandridge acreage is capable of supporting pasture of high quality, but the carrying capacity, especially of the shallower south-facing slopes, is greatly limited by lack of moisture.

STEEP DANDRIDGE-WHITESBURG-HAMBLEN SOIL ASSOCIATION

Stronger slope is the chief difference between this soil association and the Dandridge-Leadvale-Hamblen soil association. Dandridge soils predominate. The ridge tops consist of very narrow strips of rolling Dandridge soils; the long slopes are predominantly steep Dandridge soils with smaller areas of hilly phases intermixed. The valley floors consist chiefly of very narrow strips of Whitesburg and Hamblen soils (pl. 9, *A*). All except the Hamblen and Whitesburg soils are shallow to bedrock and fairly low in fertility. Upland moisture relations are not favorable; water-holding capacity is low and runoff develops quickly. The aggregate area of this association is about 5 percent of the county. This is a significant but less extensive area than that occupied by the Dandridge-Leadvale-Hamblen soil association.

Much of this association is in cut-over deciduous or reestablished forest, but some of it is idle or in unimproved pasture. Cultivated areas are confined chiefly to the narrow strips of Whitesburg and Hamblen soils. These soils are productive, but the areas suited to cultivation are very limited. Only a few farms occur in this association, and they are among the least prosperous in the county. Much of the acreage is probably best used for forest. The limited acreage along the draws and creeks is suited to intensive use, and some of the gentler slopes are suitable for pasture.

TEAS-STONY LAND SOIL ASSOCIATION

The Teas-Stony land soil association consists of hilly to steep stony soils that are shallow to bedrock. The aggregate area, 0.5 percent of the county, is made up of small individual bodies on the northwest foot slopes of Stone and Neddy Mountains. The soils are not productive and only a small part of the acreage is cleared. The association is used chiefly for forest. The less stony and less steep areas could support pasture if they were properly fertilized and seeded.

RAMSEY (SANDY)-STONY LAND SOIL ASSOCIATION

The Ramsey (sandy)-Stony land soil association consists of rugged steep stony mountain slopes. The parent rock is chiefly quartzite and sandstone. There is little soil material, and rock outcrops and loose rock are abundant. Nearly all of this association is under mixed deciduous and pine forest. It occupies about 23 percent of the county, or a major part of English, Stone, Neddy, and Meadow Creek Mountains and much of the wide strip of mountainous land in the southeastern part of the county.

This stony, rugged association is suited to neither crops nor pasture. It is capable of producing forest, but most of it is difficult to reach, and it is thought that trees grow slowly except on the most favorable sites.

RAMSEY (SILT LOAM)-HAMBLEN SOIL ASSOCIATION

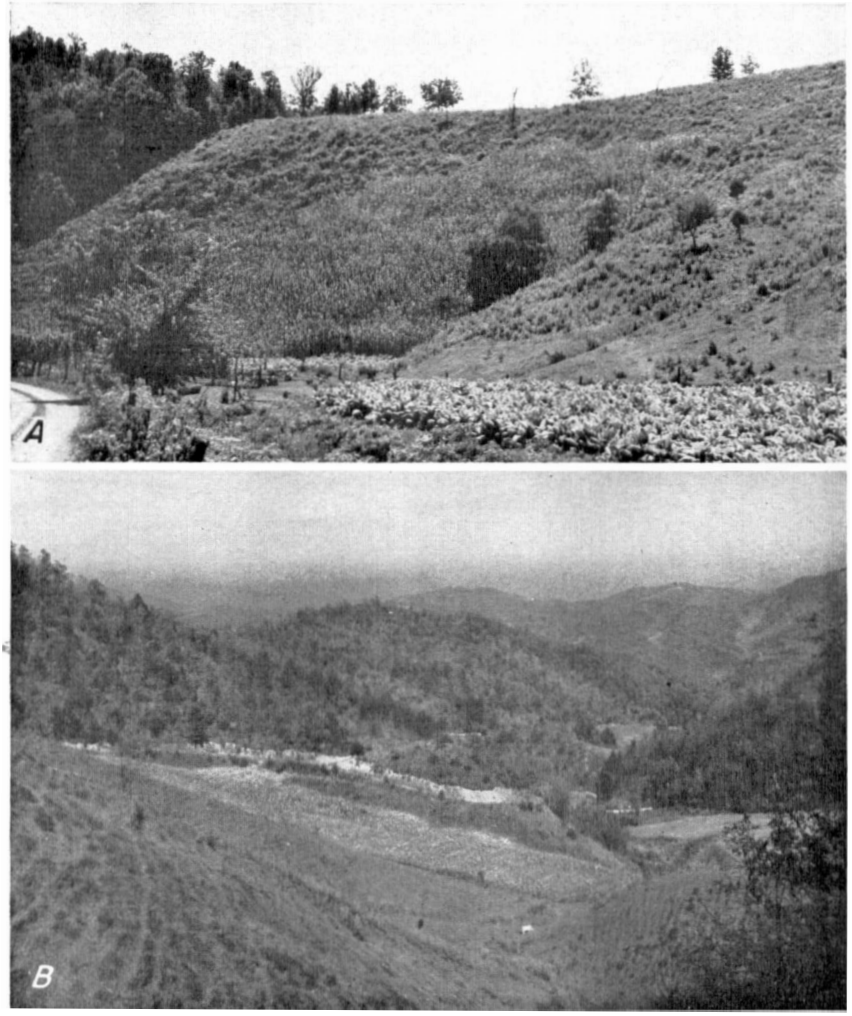
The Ramsey (silt loam)-Hamblen soil association is predominantly steep but in some parts hilly. Throughout the association area occur narrow strips of bottom land, which are important because they comprise most of the cropland. Although predominantly hilly and steep, most farms in this association have some acreage of nearly level soils on the bottom lands. The upland soils are silt loams or slaty silt loams, shallow to bedrock. They are moderately fertile, but their steep slopes and shallowness limit their water-holding capacity. They are extremely erosive when cultivated. The aggregate area of this association is about 20 percent of the county. It is mostly south of Stone Mountain.

Though predominantly hilly and steep, this association is less rugged than the Ramsey (sandy)-Stony land association and its general relief is less. Most of the steepest area is in cut-over deciduous forest (pl. 9, *B*), and the cleared area is used as unimproved pasture. A small part of the less steep uplands is used for crops, but yields are low and erosion is active. Most of the bottom land is used intensively for crops, chiefly hay and corn. Yields are relatively high.

This association appears to have limited suitability for a livestock type of farming, practiced with forestry and supplemented by a small cash-crop acreage. Most of the bottom land has good tilth and favorable moisture relations and is capable of producing high yields when adequately fertilized.

JEFFERSON-ALLEN-BARBOURVILLE SOIL ASSOCIATION

The Jefferson-Allen-Barbourville soil association is rolling to steep and consists chiefly of old alluvium on which Jefferson soils predominate. Narrow strips of Barbourville and Cotaco soils occur along the drainways. Most of the Jefferson soils have stones that interfere with cultivation, and some areas are so stony that cultivation is impractical. Dandridge soils occupy some of the steepest slopes. About 10 percent of the county is in this association. Most of the association occurs as belts or foot slopes along the lower edge of the rugged mountain areas, chief of which are those around English, Stone and Meadow Creek Mountains.



A, Strong slopes and narrow valley floors characterize the Steep Dandridge-Whitesburg-Hamblen soil association—tobacco in foreground on Whitesburg silt loam; Dandridge shaly silt loam, eroded steep phase, on slope. (By courtesy of Tennessee Valley Authority.)

B, Cut-over deciduous forest on Ramsey (silt loam)-Hamblen soil association; small areas of Barbourville and Hayter soils along drains used chiefly for subsistence crops and tobacco.

Most of the less tillable areas are still in cut-over forests; the cleared areas are used for crops and pasture. The soils are lower in fertility than those of the Dunmore-Greendale and Dewey-Dunmore soil associations but respond to proper fertilization and management. Many truck crops are adapted. General livestock farming, supplemented by small acreages of truck crops and tobacco, is widely practiced. Grasses and legumes are fairly productive if properly fertilized and seeded, but generally less so than on soils of the Dunmore-Greendale and Dewey-Dunmore soil associations.

STONY LAND-ASHE SOIL ASSOCIATION

The Stony land-Ashe soil association occupies the highest parts of the mountains and all the acreage is along the divide that forms the boundary between Cocke County and Haywood and Madison Counties in North Carolina. The aggregate area is about 5 percent of the county. Most of this association consists of steep to very steep stony soils and stony land types. A small acreage of rolling and hilly soils occurs on parts of the ridge crests. Much of this association is under forest. The cleared areas, confined to the rolling and hilly Ashe soils, are suited to crops or pasture. The smoothest areas are well suited to potatoes, cabbage, and certain other truck crops, as well as general farm crops, but they require heavy fertilization. The hilly Ashe soils are capable of producing pasture.

SUITABILITY CLASSES

Soil groupings made according to their degree of suitability for general farm uses are called suitability classes. In descending order of suitability, the classes are First, Second, Third, Fourth, and Fifth. Soils of the first three classes are suitable for crops requiring tillage; those of the Fourth class are not well suited to tilled crops but suitable for pasture; and those of the Fifth class are poorly suited to either crops or pasture but usually suitable for forest.

Suitability classes are not keys to the agricultural value of land; for location of individual soil areas, association of one soil with others, and the benefits or injuries from past management are not considered in making the groupings.

Soils in any one suitability class are not alike in characteristics. First-class soils are more nearly alike than those in any of the other four classes. All First-class soils are fertile, permeable, smooth, and deep to bedrock. The range in characteristics among First-class soils is fairly limited, whereas the range is greater among Second-class soils and still greater among Third-class soils. One Third-class soil, for example, may not be well suited to cultivation because of poor drainage. Another Third-class soil may have good drainage but be too strongly or steeply sloping for cultivation. Yet another Third-class soil may have good drainage and gentle slope but have too great a stone content for cultivation.

The soils of the county are listed by suitability classes as follows:

FIRST-CLASS SOILS

Congaree loam
Cumberland silty clay loam, eroded undulating phase
Emory silt loam
Staser silt loam
State loam
Waynesboro loam, undulating phase

SECOND-CLASS SOILS

Allen fine sandy loam, eroded rolling phase
Allen fine sandy loam, rolling phase
Altavista loam
Augusta silt loam
Barbourville fine sandy loam
Barbourville silt loam
Camp silt loam
Chewacla fine sandy loam
Congaree fine sandy loam
Dewey silty clay loam, eroded rolling phase
Dunmore silt loam, rolling phase
Dunmore silty clay loam, eroded rolling phase
Greendale silt loam
Groseclose silt loam, rolling phase
Groseclose silty clay loam, eroded rolling phase
Hamblen fine sandy loam
Hamblen silt loam
Hayter silt loam, eroded rolling phase
Holston loam, undulating phase
Leadvale silt loam, undulating phase
Lindside silt loam
Nolichucky loam, eroded rolling phase
Nolichucky loam, undulating phase
Ooltewah silt loam
Sequatchie fine sandy loam
Staser fine sandy loam
Tusquitee silt loam, rolling phase
Waynesboro loam, eroded rolling phase
Whitesburg silt loam

THIRD-CLASS SOILS

Allen fine sandy loam, eroded hilly phase
Allen fine sandy loam, hilly phase
Ashe loam, hilly dark-colored phase
Ashe loam, hilly phase
Barbourville stony fine sandy loam
Buncombe loamy fine sand
Cotaco fine sandy loam
Dandridge and Litz shaly silt loams, eroded rolling phases
Dandridge and Litz silt loams, rolling phases
Dandridge shaly silt loam, eroded rolling phase
Dandridge silt loam, rolling phase
Dewey silt loam, hilly phase
Dewey silty clay loam, eroded hilly phase
Dunmore silt loam, hilly phase
Dunmore silty clay loam, eroded hilly phase
Dunmore silty clay, severely eroded rolling phase
Groseclose silt loam, hilly phase
Groseclose silty clay loam, eroded hilly phase
Holston clay loam, severely eroded rolling phase
Holston cobbly loam, eroded rolling phase
Holston cobbly loam, rolling phase
Holston cobbly loam, undulating phase
Holston loam, eroded hilly phase
Holston loam, eroded rolling phase
Jefferson-Dunmore complex, eroded hilly phases
Jefferson-Dunmore complex, hilly phases
Jefferson loam, eroded rolling phase
Jefferson stony sandy clay loam, severely eroded rolling phase
Jefferson stony sandy loam, eroded rolling phase
Jefferson stony sandy loam, rolling phase
Leadvale silt loam, rolling phase
Litz shaly silt loam, eroded rolling phase
Monongahela silt loam
Monongahela silt loam, eroded phase
Nolichucky clay loam, severely eroded rolling phase
Nolichucky cobbly loam, eroded rolling phase
Nolichucky cobbly loam, rolling phase
Nolichucky loam, eroded hilly phase
Nolichucky loam, hilly phase
Sequatchie cobbly fine sandy loam
Staser cobbly fine sandy loam
Tusquitee silt loam, hilly phase
Waynesboro clay loam, severely eroded rolling phase
Waynesboro loam, eroded hilly phase

FOURTH-CLASS SOILS

Allen stony fine sandy loam, eroded hilly phase
Dandridge and Litz shaly silt loams, eroded hilly phases
Dandridge and Litz shaly silt loams, eroded steep phases
Dandridge and Litz silt loams, hilly phases
Dandridge shaly silt loam, eroded hilly phase
Dandridge shaly silt loam, eroded steep phase
Dandridge silt loam, hilly phase
Dandridge silt loam, steep phase
Dandridge and Litz silt loams, steep phases
Dewey silty clay loam, eroded steep phase
Dunmore silt loam, steep phase

FOURTH-CLASS SOILS—Continued

Dunmore silty clay, severely eroded hilly phase
Dunmore silty clay loam, eroded steep phase
Holston clay loam, severely eroded hilly phase
Holston cobbly loam, eroded hilly phase
Holston cobbly loam, hilly phase
Jefferson-Dunmore complex, severely eroded hilly phases
Jefferson stony sandy clay loam, severely eroded hilly phase
Jefferson stony sandy loam, eroded hilly phase
Jefferson stony sandy loam, hilly phase
Jefferson very stony sandy loam, eroded hilly phase
Jefferson very stony sandy loam, hilly phase
Jefferson very stony sandy loam, eroded rolling phase
Jefferson very stony sandy loam, rolling phase
Jefferson very stony sandy loam, eroded steep phase
Jefferson very stony sandy loam, steep phase
Litz shaly silt loam, eroded hilly phase
Litz shaly silt loam, steep phase
Nolichucky clay loam, severely eroded hilly phase
Nolichucky cobbly loam, eroded hilly phase
Nolichucky cobbly loam, hilly phase
Prader silt loam
Ramsey shaly silt loam, eroded hilly phase
Ramsey shaly silt loam, eroded steep phase
Ramsey shaly silt loam, hilly phase
Ramsey shaly silt loam, steep phase
Ramsey stony fine sandy loam, hilly phase
Stony hilly land (Dunmore soil material)
Teas silt loam, hilly phase
Tyler silt loam
Waynesboro clay loam, severely eroded hilly phase
Waynesboro cobbly loam, eroded hilly phase
Wehadkee silt loam

FIFTH CLASS SOILS

Ashe loam, steep phase
Dandridge and Litz silt loams, very steep phases
Dandridge silt loam, very steep phase
Dunmore silty clay, severely eroded steep phase
Gullied land (Dandridge soil material)
Gullied land (Dunmore soil material)
Jefferson stony sandy loam, eroded steep phase
Ramsey shaly silt loam, very steep phase
Ramsey stony fine sandy loam, eroded steep phase
Ramsey stony fine sandy loam, steep phase
Riverwash
Rock land (limestone)
Rough mountainous land (Ramsey soil material)
Stony colluvium (Jefferson soil material)
Stony rough land (Ashe soil material)
Stony steep land (Dunmore soil material)
Teas shaly silty clay loam, eroded steep phase
Teas silt loam, steep phase

MORPHOLOGY AND GENESIS OF SOILS

Soil is the product of soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the character of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material (*10*). Climate and vegetation are more important in the development of the common properties of the soils of the county, whereas, age, relief, and parent materials largely account for the local differences among the soils.

Active factors in soil genesis.—Climate and vegetation are active factors in soil genesis. They act on the parent material accumulated through the weathering of rocks and slowly change it into a natural

body with genetically related horizons. The effects of climate and vegetation are conditioned by relief, which influences drainage, the rate of natural erosion, and the kind of vegetation growing on the soil. The nature of the parent material also affects the kind of profile that can be formed and in extreme cases dominates it entirely. Finally, time is needed for the changing of the parent material into a soil profile. The time needed for horizon differentiation may be much or little, but some time is always required. Usually a long interval of time is needed for the development of distinct horizons.

Relations among soil-forming factors.—The interrelationships among the factors of soil formation are complex; it is hard to isolate the effects of any one with certainty. It is possible to find some areas where four of the factors are constant, or nearly so, and in such areas the effects of the fifth factor can be partly evaluated. Even in such places, the measurements of the one factor are approximations of the actual effects. It is convenient to discuss the individual factors and their effects in soil formation, but the reader should remember that it is the integrated influence of these factors, not a simple summation of them, that determines the nature of the soil profile.

Morphological characteristics.—The purpose of this section is to present the outstanding morphological characteristics of the soils of Cocke County and to relate them to the factors of soil formation. Physical and chemical data are limited for these soils, and the discussion of soil genesis and morphology is correspondingly incomplete. The first part of the section deals with the environment under which the soils exist; the second with specific soil series and the part environment has played in determining their morphologies.

FACTORS OF SOIL FORMATION AS RELATED TO COCKE COUNTY SOILS

PARENT MATERIAL

The parent materials of the soils of Cocke County may be considered in two broad classes: (1) Material residual from the weathering of rocks in place; and (2) materials transported by water or gravity and laid down as unconsolidated deposits of clay, silt, sand, and large rock fragments. Materials of the first class are related directly to the underlying rocks from which they were derived; materials of the second class are related to the soils or rocks from which they were carried.

The parent materials formed in place consist of the residuum of igneous, sedimentary, and metamorphic rocks; the properties of these rocks are strongly reflected in many of the properties of the soils that have developed from them. The igneous rocks include granite; the sedimentary rocks include limestone, dolomitic limestone, sandstone, conglomerate, and shale; and the metamorphic rocks include quartzite, slate, and gneiss. Geologically, the rocks are very old. The sedimentary rocks were formed in the early part of the Paleozoic Era, and the igneous rocks in the Proterozoic and Archeozoic Eras (*2*). Most of the rock formations are folded and faulted and generally have a decided dip.

In general, the characteristics of soils developed in place, that is from sedentary material, show a relationship to their parent rock. This relationship also exists among soils consisting of alluvium, but is less obvious because in great part the alluvial deposits are mixtures

of materials from many parent rocks. Table 25 shows the parent rocks for each of the soil series.

Although a fairly consistent relationship exists between the kinds of parent materials and some of the properties of soils, other soil properties, especially those of regional significance from the standpoint of soil genesis, cannot be correlated with kinds of parent materials and must be attributed to other factors.

CLIMATE

Cocke County has a humid temperate climate. The mountain areas have cooler summers and lower average temperatures throughout the year than the valleys. Precipitation is also heavier and includes more snow.

The high rainfall throughout the county favors rather intense leaching of soluble and colloidal materials downward in the soil. Since the soil is frozen for only short periods, especially in the valleys, and to only shallow depths, weathering and translocation of materials continues almost uninterruptedly. The lower temperatures in the mountainous areas slow chemical reactions in the soils, which are also frozen for longer periods and to greater depths than in the valleys. As a result, leaching is retarded.

Within any climatic zone, climate is responsible for many of the outstanding characteristics that the well-developed, well-drained soils have in common. In this county, however, differences in climate are not great enough to account for the broad differences that exist among the soils. The climate over the larger part of the county has characteristics of the climates of both the Red-Yellow Podzolic and Gray-Brown Podzolic soil regions. The county has Red-Yellow Podzolic and Gray-Brown Podzolic soils in intimate association. It is apparent that differences in such factors as parent material, drainage, and age have been of primary importance in determining the great soil group to which the soils belong.

PLANT AND ANIMAL LIFE

Trees, shrubs, grasses, and other herbaceous plants, micro-organisms, earthworms, and various other forms of plant and animal life live on and in the soil and are active agencies in the soil-forming processes. The nature of the changes that these various biological forces bring about depends, among other things, on the kinds of life and the life processes peculiar to each. The kinds of plants and animals that live on and in the soil are determined by environmental factors, including climate, parent material, relief, age of the soil, and the associated organisms. The influence of climate is most apparent, though not always most important, in determining the kinds of macroflora that grow on the well-drained, well-developed soils. In this way, climate exerts a powerful indirect influence on the morphology of soils. Climate and vegetation acting together are the active factors of soil genesis.

In general a yellow pine-hardwood forest was on most of the well-developed soils, though locally there may have been almost pure stands of hardwood. A spruce-fir forest predominates in a few places at elevations above sea level of about 4,500 feet or more. A few areas at this higher elevation have a cover of grasses, alders, and rhododendron.

There were probably differences in the density of forest stands, the relative proportion of species, and the associated ground cover. Taking the area as a whole, however, the forests appear to have been relatively uniform except for places at high elevations and, it is doubtful that any of the marked differences in properties among the well-drained, well-developed soils are the direct result of differences in vegetative cover.

Most of the trees that grow in this area are moderately deep to deep feeders on plant nutrients in the soil. They are chiefly deciduous trees, which shed their leaves annually. The content of various plant nutrients in the leaves of different species ranges considerably, but leaves from deciduous trees usually contain somewhat more of phosphorus and bases than the needles from coniferous trees. In this way, essential plant nutrients are returned to the upper part of the soil from the lower part and counteract the depleting action of percolating waters.

Much organic material is added to the soil in the form of dead leaves, roots, and entire plants. Most of it is added to the A horizon, where it is acted upon by micro-organisms, earthworms, and other forms of life and by direct chemical reactions. In Cocke County, such materials decompose rather rapidly because of favorable temperature and moisture, favorable character of the organic material itself, and presumably favorable micropopulation of the soil. Organic material does not accumulate on well-drained sites in the valleys to the extent that it does in cooler regions in the mountains or in the poorly drained sites in the valleys.

Little is known of the micro-organisms, earthworms, and other forms of life in the soils of the county. The effects of the soil population, though important to soil genesis, have not been adequately determined.

DEGREE OF SOIL DEVELOPMENT

The well-drained, well-developed soils have been formed under relatively similar conditions of climate and vegetation. It is on these soils that climate and vegetation have had the maximum influence and relief and age have had minimum influence. As a result, these soils, though developed from various kinds of parent materials, have many properties in common.

In the virgin condition all of the well-drained, well-developed soils have a layer of organic debris in varying states of decomposition on the surface. All have dark-colored A_1 horizons. The A_2 horizons are lighter in color than either the A_1 or the B. Generally, the B horizon is uniformly colored yellow, brown, or red and is heavier textured than the A_1 or A_2. The C horizon is variable in color and texture among the different soils, but it is usually light red or yellow mottled with gray or brown.

The properties just mentioned are common to all well-developed, well-drained soils and have been subjected to similar conditions of climate and vegetation. They are, therefore, common to soils of zonal extent, and all soils that exhibit them are called zonal soils. Zonal soils are members of one of the classes of the highest category in soil classification and are defined as those great groups of soils having well-developed soil characteristics that reflect the influence of the active factors of soil genesis—climate and living organisms (*10*).

In places in Cocke County where the parent materials have been in place a long time and have not been subject to extremes in relief or in the parent material itself, the developed soils have zonal characteristics. In places where the parent material has been in place only a short time, as in the case of recently transported materials, the soils have poorly defined or no genetic horizons. These soils are young and have few or none of the properties of zonal soils and, therefore, are called azonal soils. Azonal soils are members of a second class of the highest category of soil classification and are defined as a group of soils without well-developed soil characteristics either because of their youth or because of conditions of parent material or relief that have prevented the development of normal soil characteristics (*10*).

The azonal soils are characterized by (1) A_1 horizons that are moderately dark in color and apparently have a moderately to fairly high content of organic matter; (2) by the absence of a zone of illuviation, or B horizon; and (3) by parent material that is usually lighter in color than the A_1 horizon and that may be similar to, lighter than, or heavier than the A_1 horizon in texture. They may be referred to as AC soils because of the absence of a B horizon.

The relief of the soils of the county ranges from nearly level to very steep. On steep areas the amount of water that percolates through the soil is relatively small. The large amount and rapid rate of runoff contribute to rapid geologic erosion, and the soils therefore are young. The materials are constantly renewed or mixed, and the changes brought about by vegetation and climate are so slight that the soils are essentially AC soils. The soils are also azonal soils.

On some nearly level areas where both internal and external drainage are restricted or where geologic erosion is very slow, soils whose materials have been in place a long time have certain well-developed profile characteristics that zonal soils do not have. Such soils are associated geographically with the zonal soils and are called intrazonal soils. They are defined as soils with more or less well-developed soil characteristics that reflect the dominating influence of some local factor of relief or parent material or age over the normal effects of climate and vegetation (*10*). The properties of such soils in this county are generally the result of level relief or age influenced greatly by the character of the parent material and the kinds of vegetation that grow in such environments.

Soils of each of the three broad classes—zonal, azonal, and intrazonal—may be derived from similar kinds of parent material. Within any one of these classes in this area major differences among soils appear to be closely related to differences in the kinds of parent materials from which the soils were derived. The thickness of soils developed from residual materials over the rocks from which they were derived is a partial function of the resistance of the rock to weathering, the volume of residue after weathering, and the rate of geologic erosion. The chemical and physical nature of the parent material modifies the rate and direction of chemical changes induced by climate and vegetation. The kind of parent material exerts a pronounced influence on the kinds of vegetation that grow on the soil, and conversely the vegetation greatly influences the kind of soil that is developed. That is, the influences of the soil-forming factors are interrelated.

Rocks have contributed to differences among soils also through their effects on relief. The rocks of most of Cocke County are old formations that are folded and faulted. The present relief is probably largely a product of differential weathering and erosion of those formations—the higher lands are underlain by more resistant rocks, whereas the valleys are underlain by less resistant rocks (*2*).

The internal drainage of soils of nearly level relief in the limestone areas is exceptionally good as a result of good subterranean drainage through caverns and crevices in the sharply dipping rocks. This subterranean drainage in the areas underlain by limestone counteracts the usual effects of gentle relief on drainage and allows the nature of the parent rock to dominate local differences among the well-developed, well-drained soils derived from the weathered materials of these rocks.

CLASSIFICATION OF SOILS

In table 25 the soil series of Cocke County are classified by order and great soil group, and the relief, source and kind of parent material, and age are given for each. Study of this table will enable the reader to understand the genetic relations of the soils more easily. In the following pages the great soil groups of the county are discussed and the soil series in each group are described.

ZONAL SOILS

RED-YELLOW PODZOLIC SOILS

Soils of the Red-Yellow Podzolic great soil group are zonal soils having (1) thin organic and organic-mineral surface layers over (2) eluviated layers ranging from dark brown to light gray that rest on (3) finer textured subsoil material ranging from red to yellow that becomes finer textured with depth. They have developed under forest vegetation in a warm-temperate moist climate. In Cocke County, the Red-Yellow Podzolic soils have developed chiefly under deciduous forest. All are well drained and have slopes ranging from gently undulating to hilly.

Dewey series

The Dewey soils have developed from high-grade calcic and dolomitic limestones. They have climate similar to that of other soils in the county, but the vegetation, especially the ground cover, is relatively dense. They are moderately erodible when cultivated; many have a profile truncated by erosion. They are more erodible than the Allen and less erosible than the Dunmore soils on similar slopes. They are medium to strongly acid.

Representative profile for virgin Dewey soil:

A_1 0 to 2 inches, dark-brown or dark grayish-brown mellow very friable silt loam with a soft fine to medium crumb structure and high organic-matter content.

A_2 2 to 12 inches, grayish-brown to light-brown friable silt loam with a moderately developed medium crumb structure.

B_1 12 to 20 inches, red (2.5YR 5/8, dry; 10R 4/8, moist) [12] to yellowish-red moderately friable heavy silty clay loam of moderate fine blocky structure; many small round brownish-black concretions.

[12] Symbols are Munsell color notations.

B_3 20 to 44 inches, red to light-red plastic silty clay with a moderate medium blocky structure; a few small concretions and small chert fragments.

B_3 44 to 60 inches, red (10YR 7/6, dry) plastic silty clay or clay showing some reddish-yellow splotches; structure particles larger but somewhat less distinct than in B_2 horizon; chert fragments more common but less completely weathered than in B_2.

C 60 to 100 inches, red or yellowish-red plastic silty clay or clay streaked and splotched with yellow, red, and some gray; contains more chert fragments than other horizons; bedrock at depths of 8 to 15 feet in most places.

Dunmore series

The Dunmore soils have formed from moderately high grade dolomitic limestone that is apparently higher in clay than that from which the Dewey soils developed. In some places the limestone contains thin lenses of shaly material. The parent material is apparently relatively low in insoluble impurities. The soils have developed on rolling to steep relief, chiefly under a deciduous forest. They probably supported a less luxuriant vegetation than the Dewey soils, which would partly account for their lighter colored A horizon. The major differences between the Dewey and Dunmore series are apparently directly or indirectly the result of differences between the parent materials.

Representative profile for virgin Dunmore silt loam:

A_1 0 to 2 inches, dark grayish-brown friable silt loam of weakly developed soft medium crumb structure and apparently high organic-matter content.

A_2 2 to 10 inches, grayish-brown to very pale-brown (10YR 8/4 when dry) and yellowish-brown (10YR 5/6 when moist) friable heavy silt loam; weak medium crumb structure.

B_1 10 to 14 inches, pale-yellow (2.5Y 8/4, dry) to strong-brown (7.5YR 5/6, moist) moderately friable silty clay loam with a weak medium blocky structure.

B_2 14 to 30 inches, reddish-yellow (7.5YR 6/6, dry) or red (2.5YR 4/8, moist), grading to red (2.5YR 4/8, dry; 10R 4/6, moist) plastic to very plastic silty clay to clay with a moderate medium blocky structure; structure faces are glossy and reddish.

B_3 30 to 38 inches, red (2.5YR 5/8, dry; 10R 4/6, moist) very plastic silty clay or clay streaked and splotched with yellow.

C 38 to 60 inches +, reddish-yellow to brownish-yellow very plastic silty clay or clay highly splotched with gray and yellow; contains a few small shale fragments and thin layers of shale in various stages of decomposition; uneven limestone bedrock at a depth of about 5 feet.

Cumberland series

The soil of the Cumberland series is a well-developed Red Podzolic soil formed from very old deposits of mixed alluvium in which limestone material appears to be a major component. Materials originating from sandstone, quartzite, shale, and slate, and, in places, granite and gneiss are intermixed. The relatively high fertility and favorable moisture conditions of this soil appears to have encouraged a heavy growth of forest, which resulted in a high content of organic matter in the upper layer. The Cumberland soil resembles the Dewey soils in many properties but is generally deeper and more friable and may have variable amounts of cobblestones throughout the profile. The soil is medium to strongly acid throughout.

TABLE 25.—*Soil series of Cocke County, Tenn., classified by higher categories, an differences in their morphology* [1]

ZONAL SOILS

Great soil group and series	Relief	Parent materi
Red-Yellow Podzolic soils:		Residuum from—
Dewey	Undulating to steep	High-grade limestone
Dunmore	Rolling to steep	Slightly clayey limestone
		Old alluvium from—
Cumberland	Undulating	Limestone, some sandsto shale.
Waynesboro	Undulating to hilly	Sandstone, quartzite, sha stone.
Nolichucky	do	do
		Old colluvium from—
Allen	Rolling to hilly	Sandstone, quartzite, co and some limestone.
		Residuum from—
Groseclose	do	Shaly limestone and lim beds of shale.
		Old alluvium chiefly from—
Holston	Undulating to hilly	Sandstone, quartzite, sha stone.
Altavista	Undulating to rolling	Gneiss and granite
Sequatchie [3]	Nearly level to undulating	Sandstone, quartzite, sha stone.
		Old colluvium from—
Jefferson	Rolling to steep	Sandstone, quartzite, and
Leadvale	Undulating to rolling	Shale
Gray-Brown Podzolic soils:		
Hayter	Rolling	Sandstone and quartzite stone or calcareous sha
State	Nearly level to undulating	Gneiss and granite

Intrazonal Soils		
Planosols:		
Monongahela	Nearly level to rolling	Old alluvium chiefly from— Sandstone, quartzite, sha
Tyler	Nearly level	----do
Augusta	Nearly level to undulating	Gneiss and granite
Azonal Soils		
Lithosols:		
Dandridge	Rolling to very steep	Residuum from— Calcareous shale
Litz	Rolling to steep	Leached calcareous shale a few limestone lenses.
Teas	Hilly to steep	Reddish or purplish shal
Ramsey	Hilly to very steep	Quartzite, conglomerate slate.
Ashe [4]	----do	Gneiss and granite
Alluvial soils:		Young alluvium chiefly from-
Staser	Nearly level to gently undulating.	Calcareous shale, slate, s quartzite.
Hamblen	Nearly level	----do
Prader [5]	----do	----do
Congaree	----do	Gneiss and granite
Chewacla	----do	----do
Wehadkee [5]	----do	----do
Buncombe	Gently undulating	Gneiss and granite (sand
Lindside	Nearly level	Limestone
		Young colluvium from—
Emory	Undulating to rolling	High-grade limestone [6]
Greendale	----do	Cherty limestone [6]
Camp	----do	Reddish or purplish shale
Ooltewah	Nearly level	Limestone
Whitesburg	Undulating to rolling	Calcareous shale
Barbourville	Undulating	Sandstone, quartzite, and
Cotaco	----do	----do
Tusquitee	Rolling to hilly	Gneiss and granite [6]

[1] Climate and vegetation are relatively uniform; therefore, with few exceptions, they cannot account for the differences in the soils except indirectly through time.

[2] Length of time the material has been in place, as indicated by degree of profile development.

[3] May be considered also

[4] Parts belong to the Gr

[5] Characterized by a gley

[6] Parts consist of old coll

Representative profile for virgin Cumberland silt loam:

A_1 0 to 2 inches, dark grayish-brown very friable loose silt loam stained dark with organic matter.

A_2 2 to 12 inches, dark-brown to brown friable heavy silt loam with a moderate medium crumb structure.

B_1 12 to 18 inches, light reddish-brown friable silty clay loam with a moderate to weak fine to medium blocky structure.

B_2 18 to 40 inches, reddish-brown to dark-red moderately friable heavy silty clay loam or silty clay with a moderate medium blocky structure; usually contains some cobblestones and pieces of gravel ½ to 8 inches in diameter.

B_3 40 to 60 inches, yellowish-red to red moderately friable heavy silty clay loam; structure less distinct and cobblestones more numerous than in B_2 horizon.

C 60 to 96 inches, gravelly or cobbly clay loam or silty clay loam, mainly yellowish-red or red but splotched and streaked with yellow and gray.

Waynesboro series

The Waynesboro soils are well-developed Red Podzolic soils derived from old deposits of alluvium. The alluvial material consists chiefly of products left by disintegration of quartzite, sandstone, and shale but includes some limestone material in places. Included is a small acreage along the French Broad River that contains much gneissic and granitic material and which represents the Hiwassee series. The B horizon of Waynesboro soils is not so fine textured and is less firm than that of the Red Podzolic soils developed from the residuum of weathered limestone. The Waynesboro substratum is pervious to water, which contributes to the rather thorough leaching of its profile. The parent material is relatively low in bases compared with that of soils derived from either limestone or alluvium chiefly from limestone. These characteristics of the Waynesboro parent material should permit somewhat more rapid development of a mature soil profile than those of parent material consisting of limestone residuum. The soils are on undulating to hilly relief. They are strongly to medium acid throughout.

Representative profile of virgin Waynesboro loam:

A_1 0 to 1 inch, gray (10YR 5/1, dry) or very dark-brown (10YR 2/2, moist) very friable loam, high in organic matter.

A_2 1 to 10 inches, very pale-brown (10YR 7/3, dry) or brown (10YR 5/3, moist) friable loam; weak fine crumb structure.

B_1 10 to 18 inches, reddish-yellow (7.5YR 6/6, dry) or yellowish-red (5YR 4/6, moist) friable clay loam with a moderate fine blocky structure.

B_2 18 to 30 inches, yellowish-red (5YR 5/8, dry) or dark-red (2.5 YR 3/6, moist) firm but friable clay loam with a moderate medium blocky structure; cobblestones ½ to 8 inches in diameter are common.

B_3 30 to 40 inches, red (2.5YR 5/8, dry) or dark-red (10R 3/6, moist) moderately friable clay loam; gravelstones and cobblestones more common than in the B_2 horizon.

C 40 to 60 inches +, yellowish-red to reddish-yellow moderately friable clay loam or sandy clay loam streaked and splotched with yellow, gray, and brown.

Nolichucky series

The Nolichucky soils have formed from old alluvium that consists mainly of residue from quartzite, sandstone, shale, and slate. In most places, however, the alluvium has a small admixture of granite and limestone materials. The soils have developed on an undulating to hilly relief under deciduous forest. The moderately low fertility has apparently resulted in poor forest growth and, consequently, in low

organic-matter content in the upper horizon. These soils are highly leached and strongly acid. They differ from the Waynesboro soils in being more highly leached and lighter in color throughout the profile.

Representative profile of virgin Nolichucky fine sandy loam:

A_1 0 to 8 inches, very pale-brown (10YR 7/3, dry) or dark-brown (10YR 4/3, moist) loose fine sandy loam or loam stained with organic matter in the upper inch.

B_1 8 to 16 inches, very pale-brown (10YR 7/4, dry) or yellowish-brown (10YR 5/8, moist) friable heavy loam or light clay loam.

B_2 16 to 30 inches, reddish-yellow to yellowish-red moderately friable clay loam of moderate medium blocky structure.

B_3 30 to 48 inches, yellowish-red firm clay loam to sandy clay with some brownish-yellow streaks.

C 48 inches +, reddish-yellow firm sandy clay loam or clay loam profusely streaked and splotched with gray and yellow.

Allen series

The Allen soils have developed from colluvial and local alluvial materials washed mainly from uplands underlain by sandstone, quartzite, conglomerate, shale, and some limestone. They are rolling to hilly. The movement of percolating water is free, and the reaction is medium to strongly acid.

Representative profile for virgin Allen stony fine sandy loam:

A_1 0 to 1 inch, dark-gray loose fine sandy loam stained dark with organic matter.

A_2 1 to 10 inches, pale-yellow (2.5Y 7/4, dry) or yellowish-brown (10YR 5/6, moist) friable stony fine sandy loam.

B_1 10 to 15 inches, very pale-brown (10YR 7/4, dry) or strong-brown (7.5YR 5/6, moist) friable loam.

B_2 15 to 22 inches, reddish-yellow (5YR 6/6, dry) or yellowish-red (5YR 4/6, moist) moderately friable stony sandy clay loam or sandy clay of moderate medium blocky structure.

B_3 22 to 34 inches, red (2.5YR 5/6, dry or 2.5YR 4/6, moist) friable stony sandy clay loam; structure less distinct than in the B_2 horizon.

C 34 to 60 inches +, red (2.5YR 4/8, dry) or dark-red (2.5YR 3/6, moist) friable sandy clay loam showing splotches of reddish-yellow (7.5YR 7/6, dry) or brownish-yellow (10YR 6/6, moist); contains many partly weathered gray and red sandstone and quartzite fragments.

Groseclose series

The Groseclose soils have developed over shaly limestone and limestone interbedded with shale. They have a light-colored friable A layer and a yellowish compact plastic subsoil. The surface layer resembles that of the Dunmore soils, but the subsoil is finer textured, more yellow, and more mottled in the lower part. The parent rock of the Groseclose soils is more argillaceous than that of the Dunmore, although the parent rock of the Dunmore is somewhat argillaceous. Groseclose soils are well drained but are less permeable than the redder soils that have developed over limestone.

A representative profile for a Groseclose silt loam:

0 to 3 inches, white to pale-yellow (2.5Y 8/2 to 8/4, dry) or light brownish-gray to light yellowish-brown (2.5Y 6/2 to 6/4, moist) friable silt loam; surface inch is darker and contains much partly disintegrated organic matter.

3 to 10 inches, very pale-brown (10YR 8/4, dry) or light yellowish-brown (10YR 6/4, moist) friable silt loam; lower part grades to reddish yellow when moist.

10 to 18 inches, yellow (10YR 8/6, dry) or reddish-yellow (7.5YR 6/8, moist) moderately compact moderate to strongly developed medium blocky silty clay.
18 to 36 inches, mottled strong-brown (7.5YR 5/8, dry and moist) and yellow (2.5Y 8/6, dry; 2.5Y 7/6, moist) compact but brittle shaly silty clay with moderate medium blocky structure.
36 inches +, partly weathered shaly dolomitic limestone.

Holston series

The Holston soils have developed from old stream alluvium derived chiefly from sandstone, quartzite, and shale. Some material from limestone is intermixed. They have undulating to hilly relief, good external drainage, and adequate but slightly restricted internal drainage. They appear to be very old and in some places have properties approaching those of the Planosols.

The Holston soils have developed from materials low in bases. Slightly restricted internal drainage may have contributed to the yellow color of the B horizon, a contrast to the reddish colored B horizons of the well-drained Nolichucky soils that developed from what appears to be similar materials. The Holston soils are strongly to very strongly acid throughout.

Representative profile for a Holston loam in a cultivated condition:

0 to 8 inches, pale-yellow (2.5Y 7/4, dry) or yellowish-brown (10YR 5/4, moist) loose loam stained dark with organic matter in the upper part.
8 to 12 inches, pale-yellow (2.5Y 8/4, dry) or yellowish-brown (10YR 5/6, moist) friable loam.
12 to 30 inches, yellow (2.5Y 8/6, dry) or brownish-yellow (10 YR 6/8, moist) moderately firm but friable clay loam faintly splotched with gray in lower part; this horizon has weak fine to medium blocky structure.
30 to 48 inches +, yellow moderately compact sandy clay loam to sandy clay highly mottled with gray and brown.

Altavista series

The Altavista soil occurs on moderately low stream terraces and consists largely of material from gneiss or granite. Its surface is smooth (undulating to rolling), and internal drainage, though moderately good, is somewhat impaired. The alluvial deposits from which this soil has developed are younger and at lower elevations than those from which Waynesboro and Nolichucky soils have developed. The reddish member (Hiwassee) of the catena to which the Altavista series belongs is inextensive and not mapped separately in this county. It occurs on high stream terraces and is included as a variation of the Waynesboro series. Altavista soil is low in organic matter and medium to strongly acid.

Following is a representative profile of Altavista loam in a cultivated condition:

0 to 10 inches, light-gray to pale-yellow loam that is darker in the upper 1½ inches.
10 to 30 inches, yellow friable to moderately compact sandy clay loam with a moderate medium blocky structure.
30 inches +, mottled yellow and gray compact but brittle sandy clay.

Sequatchie series

The soils of the Sequatchie series are on low stream terraces or second bottoms along the larger creeks and rivers. They have developed from parent materials similar to those of the Staser and

Hamblen series and are usually closely associated with them geographically. Relief is nearly level to undulating. The soils developed under a hardwood forest and climatic conditions similar to those for other zonal soils of the Ridge and Valley province. Some of the materials from which Sequatchie soils were derived, however, were so recently deposited that only weak profile development is apparent. The differences between Sequatchie and the Holston soils are probably largely the result of differences in age.

Representative profile for virgin Sequatchie fine sandy loam:

0 to 2 inches, dark grayish-brown loose fine sandy loam with a relatively large organic-matter content.
2 to 14 inches, brown (10YR 5/3, dry) to very dark grayish-brown (10YR 3/2, moist) very friable fine sandy loam.
14 to 36 inches, pale-brown (10YR 6/3, dry) to yellowish-brown (10YR 5/4, moist) friable loam with a weak medium blocky structure and a lighter color with depth.
36 inches +, light yellowish-brown very coarse sand and fine gravel.

Jefferson series

Soils of the Jefferson series occur on foot slopes and benches at the base of mountain slopes. Their parent materials are local alluvium and colluvium washed chiefly from the Ramsey soils on adjoining uplands. In some places the local alluvium has washed from soils overlying slate, shale, or limestone. The Jefferson soils are rolling to steep and well drained. In most places they have developed under mixed forest of hardwoods and pines in a climate essentially the same as for the other zonal soils of the Ridge and Valley province. The materials, however, are low in bases and the Jefferson soils are acid in reaction.

Representative profile for virgin Jefferson stony fine sandy loam:

0 to 2 inches, light brownish-gray (2.5Y 6/2, dry) to very dark grayish-brown (10 YR 3/2, moist) loose fine sandy loam, stained with organic matter.
2 to 16 inches, pale-yellow (2.5Y 8/4, dry) to light olive-brown (2.5Y 5/4, moist) very friable stony fine sandy loam.
16 to 30 inches, pale-yellow (2.5Y 8/4, dry) to yellowish-brown (10Y 5/6, moist) friable stony coarse loam.
30 to 50 inches, very pale-brown (10YR 8/4, dry) stony coarse loam with some reddish mottles in lower part.
50 to 72 inches +, mottled yellow and red friable stony sandy clay loam.

Leadvale series

The Leadvale soils are developed in moderately old to old colluvium that came chiefly from shale. Most of the shale parent to the Leadvale soils in this county is calcareous, but the soils are medium to strongly acid. Much of the acreage has shale bedrock within 8 feet of the surface, and frequently it is less. Internal drainage is moderately slow because the compact substratum retards percolation. The soil is low in organic matter and plant nutrients. The Leadvale profile is well developed, and in places the mottled horizon is compact.

Representative profile of virgin Leadvale silt loam:

0 to 6 inches, light-gray to pale-yellow (2.5Y 7/2 to 7/4, dry) or light olive-brown (2.5Y 5/4, moist) mellow silt loam; the upper 1½ inches notably darker in virgin areas because of much partly disintegrated organic matter.

6 to 24 inches, very pale-brown (10YR 7/4, dry) or strong-brown (7.5YR 5/6, moist) friable silty clay loam of moderate medium blocky structure.
24 inches +, mottled pale-yellow (2.5Y 8/2 to 8/4, dry) or light yellowish-brown (2.5Y 6/4, moist) to yellow (10YR 7/6, dry) and white (2.5Y 8/2, dry) compact brittle silty clay loam or silty clay.

GRAY-BROWN PODZOLIC SOILS

Gray-Brown Podzolic soils are a zonal group of soils having a comparatively thin organic covering and organic-mineral layers over a grayish-brown leached A horizon that rests upon an illuvial B horizon. The soils have developed under deciduous forest in a cool temperate moist climate. They have a surface covering of leaf litter, usually from deciduous trees; a dark, thin, mild (only slightly or moderately acid) humus, somewhat mixed with mineral soil; a grayish-brown crumb-structured loamy A_1 horizon and a light grayish-brown or grayish-yellow A_2 horizon; and a moderately heavy blocky structured yellowish-brown, brown, brownish-yellow, or reddish-brown B horizon, becoming lighter colored with depth. The total depth of the solum varies considerably but seldom exceeds 4 feet. Podzolization is the main process in the development of these soils (*10*).

Hayter series

The Hayter soil has developed from old colluvium and local alluvium. The colluvium came from slopes underlain mainly by slate, much of which has thin dikes of calcite in it. It is thought that this calcite may be the chief factor differentiating the Hayter soil from Leadvale and Jefferson soils. Most of the colluvial materials have been in place long enough for the development of the Gray-Brown Podzolic soil profile normal for the area. Hayter soil has a much browner profile and more organic matter than Jefferson soils. It differs from the Allen soils in having a darker surface layer and a brown rather than a red subsoil. The reaction is medium acid.

Representative profile of Hayter silt loam in a cultivated condition:

A_1 0 to 6 inches, light yellowish-brown (10YR 6/4, dry) to dark-brown (7.5YR 4/4, moist) loose loam, stained dark with organic matter in the upper 2 inches.
A_2 6 to 10 inches, very pale-brown (10YR 7/4 to 6/4, dry) to dark-brown (7.5YR 4/4, moist) friable silt loam with a weak soft crumb structure.
B_1 10 to 18 inches, yellowish-red friable light silty clay loam of weak fine blocky structure.
B_2 18 to 30 inches, very pale-brown to yellow (10YR 7/4 to 7/6, dry) or yellowish-brown (10YR 5/8, moist) friable silty clay loam with a moderate medium blocky structure; this horizon has a more reddish cast in places; slate bedrock at depths of 2 to 8 feet.

State series

The soil of the State series resemble the Sequatchie soils in color, texture, structure, and position (low stream terraces). Differences between these soils arise from parent material. The materials of the State soil originate from gneiss and granite. State soil has nearly level to undulating relief and moderate to rapid internal drainage. Natural fertility is high, and a moderate quantity of organic matter occurs in the surface 15 inches or so. The reaction is medium to strongly acid.

A representative profile of State loam in a cultivated condition:

0 to 7 inches, pale-brown (10YR 6/3, dry) to very dark grayish-brown (10YR 3/2, moist) friable loam.
7 to 20 inches, same as above in some places but slightly darker in others.
20 to 36 inches, yellow to light yellowish-brown (10YR 6/4, dry) or brown to dark-brown (7.5YR 4/4, moist) friable clay loam with moderate medium blocky structure.
36 to 48 inches, light yellowish-brown (2.5Y 6/4, dry) to yellowish-brown (10YR 5/6, moist) loam; weak medium blocky structure.
48 to 72 inches, light yellowish-brown (2.5Y 6/4, dry) to yellowish-brown (10YR 5/6, moist) friable fine sandy loam with very weak structure.
72 inches +, pale-yellow (2.5Y 7/4, dry) to yellowish-brown (10YR 5/8, moist) loamy fine sand.

Mica flakes occur throughout the profile.

INTRAZONAL SOILS

PLANOSOLS

Planosols are an intrazonal group of soils with eluviated surface horizons underlain by B horizons more strongly illuviated, and with a cemented, or compacted horizon; they developed upon nearly level upland under grass or forest vegetation in a humid or subhumid climate (*10*).

In Cocke County the Monongahela, Tyler, and Augusta series have been designated as Planosols. They have nearly level or slightly depressional to undulating relief and are poorly or imperfectly drained. The subsoil horizon is more dense or compacted than for most zonal soils, but its degree of development varies.

Climatic conditions are similar to those under which the zonal soils developed, but these Planosols are moister and less well aerated. Some differences probably existed between the kinds of vegetation on the Planosols and Red-Yellow Podzolic soils, though deciduous forest occupied both.

From the standpoint of profile development the Planosols appear older than the Red-Yellow Podzolic soils, but the causes for development of these older soils are not known. The relief is such that geologic erosion is slow or inconsequential, but that factor alone is not the cause of their formation. The soil material itself is not older in years than that of associated zonal soils of similar relief. It is possible that relatively dense layers in the parent material and underlying rock strata caused slow internal drainage which, combined with slow external drainage and unusual heaviness of the parent material, contributed to abnormal concentration or cementation of the material in or below the illuvial horizon.

Monongahela series

The Monongahela soils are closely associated with the Holston soils and like them have developed on old stream alluvium derived mainly from weathered shale and sandstone. They have developed under somewhat inferior drainage caused partly by their gently slope and partly by less permeable underlying material. They are imperfectly to moderately well drained, and a compact layer has formed at a depth of about 2 feet.

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Representative profile of virgin Monongahela silt loam:

0 to 1 inch, medium-gray very friable silt loam moderately high in organic matter.
1 to 12 inches, white (2.5Y 8/2, dry) to pale-brown (10YR 6/3, moist) floury silt loam.
12 to 24 inches, pale-yellow (2.5Y 8/4, dry) to light yellowish-brown (2.5Y 6/4, moist) friable silty clay loam with a moderate fine blocky structure.
24 to 36 inches, mottled pale-yellow and light-gray compact silty clay loam or silty clay with yellow specks.
36 to 48 inches, mottled white or light-gray and brownish-yellow silty clay loam, firm but less compact than horizon above.

Tyler series

The Tyler soil has parent materials similar to those of the Monongahela and Holston soils but is more poorly drained than either of them. It has developed from old alluvium—chiefly materials weathered from shale and sandstone—on nearly level or slightly depressional terraces. Internal and external drainage were slow during development. The differences between the Tyler soil and the Holston and Monongahela soils are caused chiefly by differences in drainage. The Tyler soil probably developed from somewhat siltier materials underlain by slowly permeable material.

Representative profile of virgin Tyler silt loam:

0 to 1 inch, medium-gray to dark-gray very friable silt loam.
1 to 8 inches, white (2.5Y 8/2, dry) to light brownish-gray (2.5Y 6/2, moist) friable floury silt loam.
8 to 20 inches, white (2.5Y 8/2, dry) mottled with yellowish-brown (10YR 5/8, moist) friable silty clay loam; weak structure; yellowish brown color is more conspicuous in some places.
20 to 40 inches, gray compact silty clay mottled with yellow; locally, this compact layer is nearer the surface.

Augusta series

The soil of this series occurs on low terraces consisting chiefly of materials that came from gneiss and granite. The areas occur in gentle depressions in association with State and Altavista soils. Although slow, internal drainage is not so slow as for many Planosols of this general region, and the surface soil is darker.

Representative profile of Augusta silt loam in a cultivated condition:

0 to 14 inches, light yellowish-brown (10YR 6/4, dry) to dark yellowish-brown (10YR 4/2, moist) silt loam.
14 to 24 inches, pale-yellow (2.5Y 7/4, dry) to yellowish-brown (10YR 5/6, moist) silty clay loam with some gray mottlings and a moderate medium blocky structure.
24 to 36 inches, mottled pale-yellow (2.5Y 7/4, dry) and white firm silty clay loam with a moderate medium blocky structure.
36 inches +, mottled white and pale-yellow firm silty clay loam that breaks into irregular fragments.

AZONAL SOILS

LITHOSOLS

Lithosols are an azonal group of soils having no clearly expressed soil morphology; they consist of a freshly and imperfectly weathered mass of rock fragments largely confined to steeply sloping land (*10*). These soils occupy sloping positions such that geologic erosion is relatively rapid. The soils generally consist of relatively easily eroded materials. As a result, material is removed from the surface or

mixed to such extent that soil-forming processes have not produced well-defined profiles. As mapped, these soils include small areas of zonal soils.

Dandridge series

Soils of the Dandridge series have formed from the residuum of calcareous shale. They are predominantly rolling to very steep, and geologic erosion apparently has been almost rapid enough to keep pace with soil development. The soils are therefore shallow, contain many shale fragments, and have very weakly developed profiles. These soils are neutral to slightly acid.

Representative profiles of virgin Dandridge shaly silt loam:

A_1 0 to 1 inch, brownish-gray very friable silt loam stained dark with organic matter.
A_2 1 to 6 inches, yellowish-gray friable shaly silt loam.
C 6 to 14 inches, brownish-yellow to yellowish-gray moderately plastic shaly silty clay loam containing many soft partly disintegrated shale fragments; becomes lighter colored and mottled with yellow and gray in lower part.
D 14 inches +, calcareous shale bedrock; depth to this bedrock varies from 8 to 24 inches.

Litz series

The Litz soils have developed from acid shale thinly interbedded with limestone or from leached calcareous shale. The areas developed from leached shale are in many places intricately associated with Dandridge soils, which occur more directly over unleached calcareous shale. The solum in the areas developed from acid shale is thin, whereas that over the leached calcareous shale in many places is several inches thicker and has a weak B horizon. The slope varies from rolling to steep. Natural fertility and organic-matter content are low, and the reaction is medium acid.

Profile of a cultivated Litz shaly silt loam soil that developed over acid shale thinly interbedded with limestone:

0 to 5 inches, grayish-yellow shaly silt loam, darker in the upper inch.
5 to 14 inches, light yellowish-brown shaly silty clay loam of a weak blocky structure; beds of pale-olive and gray fissile shale occur below this horizon.

Profile of a cultivated Litz shaly silt loam that developed over leached calcareous shale:

0 to 6 inches, yellowish-gray shaly silt loam, darker in the upper inch.
6 to 20 inches, brownish-yellow silty clay loam with a weak medium blocky structure; soft shale fragments abundant; brownish-yellow soft shale occurs below this horizon.

Teas series

The Teas soils are recognized by their pinkish-gray or purplish color. They are shallow to weak-red or purplish shale bedrock, parts of which are calcareous. The solum is weakly developed, and rock outcrops are common on the steeper slopes. The weak-red color is evident throughout the profile. Internal drainage is adequate for normal development, and the solum is medium acid.

Representative profile of virgin Teas silt loam.

0 to 3 inches, pinkish-gray (7.5YR 6/2, dry) to dark reddish-gray (5YR 4/2, moist) silt loam.
3 to 6 inches, light reddish-brown (5YR 6/3, dry) to reddish-brown (5YR 4/3, moist) silt loam.

6 to 18 inches, light reddish-brown silty clay loam with a weak medium blocky structure.
18 to 24 inches, pink (5YR 7/3, dry) to reddish-brown (5YR 4/3, moist) silty clay loam with many rock fragments; weak-red shaly bedrock material below this.

In places the profile contains more sand, the surface layer being more nearly a loam and the subsoil a clay loam.

Ramsey series

Soils of the Ramsey series have developed from weathered acid quartzite, sandstone, conglomerate, or in places from acid shale and slate, materials. Development took place chiefly under hardwood forest, although locally there is now considerable pine in the forest cover. The soils are on hilly to very steep mountain slopes.

Because the rocks under the Ramsey soils weather slowly, their parent material formed slowly. As this material is removed by geological erosion almost as rapidly as it is formed, the soils are shallow and do not have well-developed profiles. These relatively infertile soils support very poor forest and are consequently low in organic matter. They are strongly acid.

Representative profile of virgin Ramsey stony fine sandy loam over quartzite:

0 to 1 inch, gray (10YR 5/1, dry) loose fine sandy loam stained with a moderate quantity of organic matter.
1 to 14 inches, pale-yellow (2.5Y 8/4, dry) to light yellowish-brown (10YR 6/4, moist) friable stony fine sandy loam.
14 to 24 inches, pale-yellow (2.5Y 7/4, dry) to yellowish-brown (10YR 5/6, moist) friable stony fine sandy loam with thin layers of soft partly disintegrated rock fragments.
24 inches +, quartzite bedrock; depth to this bedrock varies from 10 to 36 inches.

Ashe series

The Ashe soils have young or moderately young profiles developed from material derived from gneiss and granite. They are on the highest mountain ridges of the county, and the more mature profiles have many characteristics of Gray-Brown Podzolic soils. Internal drainage is good, the reaction is strongly acid, and natural fertility is low. Slopes are hilly to very steep. The more mature profiles occur on the less steeply sloping areas. Some areas have a darker than normal surface layer and are recognized in Cocke County as a dark-colored phase.

Profile description for virgin Ashe loam, steep phase:

0 to 1 inch, grayish-brown (2.5Y 5/2, dry) to very dark grayish-brown (10YR 3/2, moist) loam.
1 to 6 inches, pale-brown (10YR 6/3, dry) and dark-brown (7.5YR 3/2, moist) grading to very pale-brown (10YR 7/4, dry) and dark yellowish-brown (10YR 4/4, moist) friable loam.
6 to 12 inches, very pale-brown to yellow (10YR 7/6, dry) and yellowish-brown (10YR 5/8, moist) friable loam or sandy clay loam.
12 to 18 inches, brighter yellow friable sandy clay loam; partly disintegrated predominantly olive-gray granitic rock below this horizon.

Rock fragments, very small to 2 or 3 inches in diameter, are common throughout the soil.

The areas mapped as the dark-colored phase have a 3-inch surface horizon of very dark grayish-brown (10YR 3/2, dry) to very dark-

brown (10YR 2/2, moist) loam underlain by 6 inches of brown (10YR 5/3, dry) to dark brown (7.5YR 3/2, moist) friable loam. Below this the material is similar to that of the normal profile.

ALLUVIAL SOILS

Alluvial soils are an azonal group of soils developed from transported and relatively recently deposited material (alluvium) characterized by a weak modification (or none) of the material by soil-forming processes (*10*). In Cocke County these soils occur on first bottoms along streams, in depressions, and on foot slopes. They have nearly level, gently sloping, or depressional relief and good to very slow internal drainage. The main properties in common are those related to a lack of a soil profile consisting of genetically related horizons. The properties of the soil are closely related to the alluvial deposit.

Alluvial soils derived from similar parent material may differ in the condition of drainage, and some differences exist because of these drainage variations. Alluvial soils derived from similar parent materials but differing in drainage have been differentiated mainly on the basis of properties associated with good, imperfect, or poor drainage.

Staser, Hamblen, and Prader series

The Staser, Hamblen, and Prader soils consist chiefly of recent alluvium that has originated mainly from shale, quartzite, sandstone, and slate. This material has been influenced by calcareous material from the original rock or from lime-bearing water. These soils are less acid than soils of the Pope-Philo-Atkins catena and a little more acid than soils of the Huntington-Lindside-Melvin catena.[18] In general, the fertility of the Staser, Hamblen, and Prader soils is lower than that of the Huntington, Lindside, and Melvin.

The Staser, Hamblen, and Prader have formed on nearly level flood plains under deciduous forest. They are subject to flooding except where protected by man-made structures. The differences among the Staser, Hamblen, and Prader soils are closely associated with differences in drainage. Soils of all three series are young and do not have well-developed profiles. They are generally higher in bases, phosphorus, and organic matter than the associated soils of the uplands.

The Staser soils are well drained and consist of grayish-brown material ranging in texture from fine sandy loam to silt loam. Below depths of 28 to 30 inches the material is mottled with yellow, gray, and brown, and the texture commonly is finer than that of the well-drained surface layer, although variations to coarser texture are common. These soils are slightly acid in most places. A dark-brown layer, representing an older surface layer buried by very recent deposition, lies at depths of 8 to 20 inches in many areas.

The Hamblen soils are imperfectly drained, grayish brown, and very friable to depths of 14 to 18 inches. The surface texture ranges from fine sandy loam to silt loam. Below this is highly mottled yellow, gray, and brown material heavier than the surface layer. The

[18] Pope, Philo, Atkins, Huntington, and Melvin soils are Alluvial soils not mapped in this county.

differences in texture may result from the soil-forming process in some instances, but in others they are more likely caused by differences in the conditions under which deposition took place.

The Prader soil is poorly drained and predominantly gray or gray mottled with yellow and brown. The surface inch contains sufficient organic matter to give it a dark cast. The surface soil is silt loam, but the material below about 10 inches is more nearly silty clay loam or silty clay. The gray sublayers of the Hamblen and Prader soils, as well as those of the Lindside, Chewacla, and Wahedkee soils, may be considered as manifestation of gleization.

Congaree, Chewacla, and Wehadkee series

The Congaree, Chewacla, and Wehadkee soils consist of recent alluvium originating chiefly from gneiss and granite. The material has not been in place long enough to develop distinct genetic horizons. The soils have developed on nearly level flood plains under a deciduous forest. The differences among soils of these three series are mainly caused by differences in drainage. The differences between the soils of this catena and those of the Staser-Hamblen-Prader catena are due to differences in the types of rocks from which the parent material was derived.

The Congaree soils are well drained and free of mottlings to a depth of more than 30 inches. The surface layer is brown (dark brown when moist) and the texture ranges from fine sandy loam to loam. The underlying material is weakly mottled yellow, gray, and brown.

The Chewacla soil is imperfectly drained. The surface layer to a depth of 15 to 18 inches is pale-brown (10YR 6/3, dry) to very dark grayish-brown (10YR 3/2, moist). Below this is strongly mottled gray, yellow, anad brown material that varies in texture from fine sandy loam to clay loam. The Chewacla soil occurs in gentle depressions in a slightly lower position than the Congaree.

The Wehadkee soil is poorly drained and predominantly gray throughout the profile. The 6-inch surface layer is light brownish gray mottled with very pale yellow and dark grayish brown. The texture is silt loam or heavy loam. Below this is light gray tight silty clay mottled with pale yellow and strong brown. The texture in many places is finer than that of the surface horizon. In many areas gray is very predominant. This soil generally occupies the lowest parts of the flood plains in which the Congaree-Chewacla-Wahadkee catena occurs. It is the first soil of the catena to be flooded, and throughout much of the year the water table is at or within a few inches of the surface.

Buncombe series

The Buncombe soil occurs on first bottoms and consist of recent alluvium derived largely from uplands underlain by gneiss and granite. The alluvium differs from that from which the Congaree soils are formed chiefly in having a larger percentage of coarser separates. These coarser materials were deposited by swift-flowing water on the natural levees. The Buncombe soil is excessively drained and consists of a grayish-brown loose loamy fine sand that grades to light yellowish-brown loamy fine sand or fine sand at a depth of 12 inches. Many mica flakes occur throughout the soil.

Lindside series

The Lindside is a young imperfectly drained soil that has not developed genetically related horizons. It consists of alluvium originating chiefly from limestone. It occurs on flood plains and is susceptible to flooding by streams. The surface soil to depths of 12 to 18 inches is grayish-brown or light-brown (dark yellowish brown when moist) mellow very friable silt loam. The subsoil is highly mottled silt loam to silty clay loam. Part of this range in texture may be caused by soil-forming processes but in most places it probably results from depositional processes.

Emory series

The Emory soil consists of recent alluvium derived from reddish soils that developed from limestone. It differs from the Greendale soil in having a brown surface soil, a reddish rather than yellowish subsoil, and greater fertility. The Emory soil occupies foot slopes, alluvial fans, and strips along intermittent drainways within areas of Dewey and Dunmore soils. Areas on the floors of limestone sinks are nearly level. Most of the acreage, however, occupies slightly higher positions and has a very gentle slope. The Emory soil is well drained and does not have a well-developed profile.

The surface 12 inches is silt loam varying from dark brown (7.5YR 4/2, dry) and dark reddish-brown (5YR 3/2, moist) to yellowish red (5YR 4/6, dry) and dark reddish brown (2.5YR 3/4, moist). These colors extend to depths of 2 or 2½ feet in places before the material becomes faintly mottled dark brown, yellow, and gray. In other places the material below 12 inches is red (2.5YR 5/8, dry) to dark-red (2.5YR 3/6, moist) silt loam or silty clay loam that grades to lighter red material with depth. Below 40 inches there is a yellowish-brown moderately plastic silty clay loam.

Greendale series

The Greendale soil occurs on foot slopes, along intermittent drains, and on alluvial-colluvial fans. It has formed from materials washed from the adjacent slopes, in this county mainly materials washed from Dunmore soils. This material is more siliceous, more strongly acid, and less fertile than that from which the Emory soils have formed. Most Greendale areas are so young and have such indistinct or weakly developed profiles that they are included with the alluvial soils. Nevertheless, some development is evident in places.

Representative profile of virgin Greendale silt loam:

0 to 2 inches, dark-gray mellow silt loam containing much organic matter.
2 to 20 inches, light yellowish-brown friable silt loam.
20 to 30 inches, very pale-brown (10YR 8/4, dry to yellowish-brown (10YR 5/6, moist), grading to light yellowish-brown, friable silt loam or silty clay loam.
30 inches +, brownish-yellow friable silty clay loam or clay loam splotched with gray.

Camp series

The soil of the Camp series consists of recent alluvium originating from reddish or purplish shale, parts of which are calcareous. It occupies gentle foot slopes, alluvial fans, and narrow strips along

drainways. The 6-inch surface layer is pink (5YR 7/3, dry) to reddish-brown (2.5YR 4/4, moist) silt loam. Below this is pink silty clay loam. Shale fragments are commonly intermixed below a depth of 18 inches.

Ooltewah series

The imperfectly drained, undeveloped Ooltewah soil consists of material originating chiefly from limestone and occupies the floors of limestone sinks. It is nearly level, and there is little or no surface drainage. Practically all areas are subject to temporary flooding during heavy rains because excess water moves away rather slowly through subterranean channels. The soil is fertile and not very acid. The 10- to 16-inch surface layer, a pale-brown to brown silt loam, is underlain by mottled yellow, gray, and brown silt loam or silty clay loam.

Whitesburg series

The soil of the Whitesburg series consists of recent alluvium originating chiefly from calcareous shale. It occupies foot slopes and strips along the intermittent drains that extend throughout the landscapes of the Dandridge and Litz soils. Both well-drained and imperfectly drained alluvial soils occupy the areas underlain by limestone, but practically all the areas over shale are imperfectly drained. There is little profile development in the Whitesburg soil. The parts adjacent to drainage channels are temporarily flooded at times. During the wettest part of the year the water table is at or within a few inches of the surface in the more poorly drained parts. A great part of the time, however, the water table is several inches below the surface, and during the driest seasons it is several feet below the surface. The older alluvium on higher parts of the foot slopes gives rise to the more mature Leadvale soils.

Profile description of Whitesburg silt loam:

0 to 6 inches, brown or pale-brown (10YR 6/3, dry) to dark grayish-brown (10YR 4/3, moist) silt loam.
6 to 14 inches, light yellowish-brown (10YR 6/4, dry) to dark-brown (10YR 4/3, moist) silt loam.
14 to 24 inches, yellowish-brown (moist) moderately friable silty clay or silty clay loam with moderate gray or brown mottling.
24 inches +, mottled gray, yellow, and brown firm silty clay loam; the gray becomes more predominant with depth.

Barbourville and Cotaco series

The well-drained Barbourville soils and the imperfectly drained Cotaco soil occur on recent alluvium originating from acid shale, slate, and sandy rocks, chiefly quartzite. They occupy very gentle foot slopes, alluvial fans, and strips along the intermittent drains in the landscapes predominated by Ramsey and Jefferson soils. Compared with the Whitesburg soil, the Cotaco and Barbourville are lower in fertility and more acid. The Barbourville soils have better internal drainage than the Whitesburg. Areas of Barbourville and Cotaco soils merge with areas of Staser and Hamblen soils farther down the drainways.

Profile of Barbourville fine sandy loam:

0 to 10 inches, pale-brown (10YR 6/3, dry) to dark-brown (10YR 4/3, moist) mellow loam or fine sandy loam.

10 to 24 inches, pale-brown or yellowish-brown friable fine sandy loam; in places this horizon may have more nearly a clay loam texture.
24 inches +, light yellowish-brown sandy loam to clay loam with some gray mottlings below 28 inches; beds of sandy gravel may occur below 24 inches.

Profile of Cotaco fine sandy loam:

0 to 18 inches, pale-yellow (2.5Y 7/4, dry) to dark yellowish-brown (10YR 4/4, moist) fine sandy loam.
18 inches +, strongly mottled light-gray, white (2.5Y 8/2, dry), pale-yellow, and brown fine sandy loam or fine sandy clay loam; mottlings may be nearer the surface than in this horizon.

Tusquitee series

Soils of the Tusquitee series consist chiefly of recent local alluvium and colluvium originating from gneiss and granite. They occupy gentle to strong foot slopes along drainways in areas of Ashe soils and Rough mountainous land (Ramsey soil material). Internal drainage of practically all areas is good. The soils are notably permeable and friable. Some of the higher lying parts of the Tusquitee areas have a moderately well-developed profile.

Following is a profile of Tusquitee silt loam:

0 to 24 inches, brown (10YR 5/3, dry) to very dark grayish-brown (10YR 3/2, moist) mellow silt loam; upper 2 or 3 inches a little darker than the rest.
24 to 36 inches, brown friable silt loam or silty clay loam with small flecks or splotches of very pale brown.
36 to 48 inches, very pale-brown (10YR 7/4, dry) to dark-brown (7.5YR 4/4, moist) friable silty clay loam.

SOIL SURVEY METHODS AND DEFINITIONS

Soil surveying consists of examining, classifying, and mapping of soils in the field. The soil scientist walks over the area and bores into the soil with an auger or digs holes with a spade. Each such boring or hole shows the soil to consist of several distinctly different layers, called horizons, which collectively are known as the soil profile. Each of these layers is studied carefully for the things about it that affect plant growth.

The color of each layer is noted. There is usually a relationship between the darkness of the color of the topmost layer of soil and its content of organic matter; streaks and spots of gray, yellow, and brown in lower layers generally indicate poor drainage and poor aeration.

Texture—the content of sand, silt, and clay in each layer—is determined by the feel of the soil when rubbed between the fingers and is checked by mechanical analyses in the laboratory. Texture determines to a considerable extent the quantity of moisture the soil will hold available to plants, whether plant nutrients or fertilizers will be held by the soil in forms available to plants or will be leached out, and the difficulty or ease of cultivating the soil.

Soil structure, or granulation, and the number of pores or open spaces between soil particles determine the permeability or perviousness of the soil, and consequently, the ease with which plant roots penetrate the soil and water enters it.

Consistence, or the tendency of the soil to crumble or to stick together, determines the degree of difficulty that will be encountered in

keeping the soil open and porous under cultivation. Consistence covers such soil characteristics as hardness, friability, plasticity, stickiness, compactness, toughness, and cementation.

Surface soil ordinarily refers to the surface layer, which is usually 5 to 10 inches thick. The layer just below the surface soil is the subsoil; the layer beneath the subsoil, the substratum.

The kind of rocks and the parent soil material that develops from these rocks affect the quantity and kind of plant nutrients found in the soil. Simple chemical tests are made to show the degree of acidity of the soil, and the depth to bedrock or to compact layers is determined. The quantity of gravel or rocks that may interfere with cultivation, the steepness and kind of slope, the quantity of soil lost by erosion, and other external features are observed.

On the basis of all the characteristics here listed, soil areas much alike in the kind, thickness, and arrangement of layers are mapped as one soil type. Some soil types are separated into two or more phases. For example, if a soil type has slopes ranging from 2 to 25 percent, the type may be mapped in three phases, an undulating phase (2 to 5 percent slopes), a rolling phase (5 to 12 percent slopes), and a hilly phase (12 to 25 percent slopes). A soil that has been eroded in places may be mapped in two or more phases—an uneroded phase, an eroded phase, and perhaps a severely eroded phase. A soil type is broken into phases primarily because of differences in the soil other than those of kind, thickness, and arrangement of layers. The slope of a soil, the frequency of outcropping bedrock found in it, the extent of its erosion, or the artificial drainage used on the soil are characteristics that might cause a soil type to be divided into phases.

Two or more soil types may have similar profiles; that is, the soil layers may be nearly the same, except that the texture, especially of the surface layer, may differ. As long as the other characteristics of the soil layers are similar, these soils are considered to belong in the same soil series. A soil series therefore consists of all soil types, whether the number be only one or several, that are, except for texture—particularly the texture of the surface layer—about the same in kind, thickness, and arrangement of layers.

The name of a place near where a soil series was first found is chosen as the name of the series. Thus Nolichucky is the name of a series of light-colored soils first found and studied mostly along the Nolichucky River. Three types of the Nolichucky series are found—Nolichucky loam, Nolichucky clay loam, and Nolichucky cobbly loam. Each of these soil types has a different surface soil texture, as its name indicates. Each of these types is divided into phases according to slope or erosion.

When very small areas of two or more kinds of soil are so intricately mixed they cannot be shown separately on a map of the scale used, they are mapped together, and the areas of the mixture are called a soil complex. Jefferson-Dunmore complex, hilly phases, is a complex of Jefferson and Dunmore soils in Cocke County.

Bare rock mountainsides, riverwash, or rough broken land that have little true soil are known as miscellaneous land types and are not designated with series and type names but are given descriptive names, as Riverwash and Rough mountainous land (Ramsey soil material).

The soil type or, where the soil type is subdivided, the soil phase, is the mapping unit in soil surveys. It is the unit or the kind of soil

that is most nearly uniform and has the narrowest range of characteristics. For this reason land use and soil management practices can be more definitely specified for it than for broader groups of soils that contain more variation.

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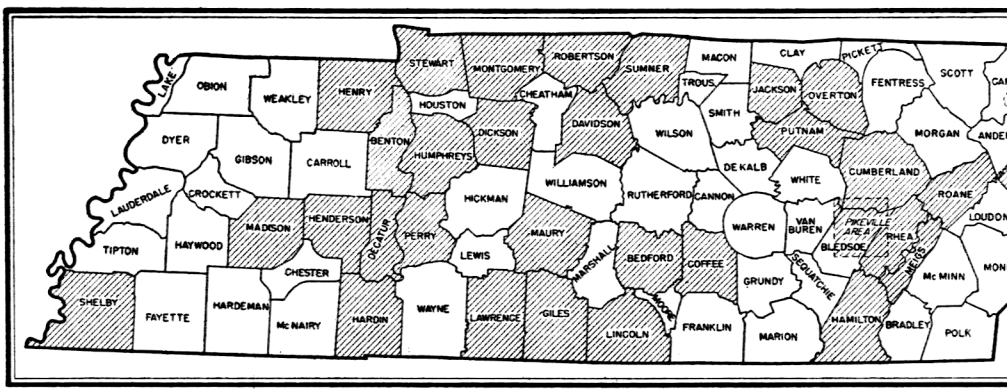

Areas surveyed in Tennessee shown by shading.

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
COCKE COUNTY-TENNESSEE
BEECH BOTTOMS SHEET

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

2 820 000 FEET — 2 840 000 FEET

83°15'00" — 12'30" — 10' — 83°07'30"

36°15'00" — 12'30" — 10' — 36°07'30"

680 000 FEET — 650 000 FEET

HAMBLEN CO. — GREENE CO. — COCKE CO.

SUSONG BRIDGE — JONES BRIDGE — CANE FORD

Forgey Island — Solomon Island — Beech Bottoms

Inman Bend — Glendale School

NOLICHUCKY RIVER — DOUGLAS RESERVOIR

Bd Beech bottoms, overflow
Cb Cobbly alluvial land
Cc Colluvial land
Cd Colluvial land, wet
Dh Dellrose silt loam, 2 to 5 percent slopes
Dl Dellrose silt loam, 5 to 12 percent slopes
Dm Dellrose silt loam, 12 to 20 percent slopes
Gf Greenback silt loam, 5 to 12 percent slopes
Hb Hayter loam, 2 to 5 percent slopes
Hd Hayter loam, 12 to 20 percent slopes
He Hayter loam, 20 to 30 percent slopes
Hf Hayter loam, 30 to 45 percent slopes
Hh Hayter gravelly loam, 2 to 5 percent slopes
Hk Hayter gravelly loam, 5 to 12 percent slopes
Hm Hayter gravelly loam, 12 to 20 percent slopes
Hn Hayter gravelly loam, 20 to 30 percent slopes
Ho Hayter gravelly loam, 30 to 45 percent slopes
Hs Hayter stony loam, 2 to 5 percent slopes
Ht Hayter stony loam, 5 to 12 percent slopes
Hu Hayter stony loam, 12 to 20 percent slopes
Hw Hayter stony loam, 20 to 30 percent slopes
Hx Hayter stony loam, 30 to 45 percent slopes
La Lily loam, 5 to 12 percent slopes
Lb Lily loam, 12 to 20 percent slopes
Ma Made land
Mb Made land, wet
Na Nolichucky loam, 2 to 5 percent slopes
Nh Nolichucky loam, 5 to 12 percent slopes
Ng Nolichucky gravelly loam, 2 to 5 percent slopes
Nn Nolichucky gravelly loam, 5 to 12 percent slopes
Rk Rock land
Sf Sandy alluvial land
Tf Talbott silt loam, 2 to 5 percent slopes
Wa Waynesboro loam, 2 to 5 percent slopes
Wd Waynesboro loam, 5 to 12 percent slopes
We Waynesboro loam, 12 to 20 percent slopes
Wg Waynesboro gravelly loam, 2 to 5 percent slopes
Wh Waynesboro gravelly loam, 5 to 12 percent slopes
Wk Waynesboro gravelly loam, 12 to 20 percent slopes
Wn Waynesboro stony loam, 2 to 5 percent slopes
Wo Waynesboro stony loam, 5 to 12 percent slopes
Ws Waynesboro stony loam, 12 to 20 percent slopes
Wt Waynesboro stony loam, 20 to 30 percent slopes
Wu Waynesboro stony loam, 30 to 45 percent slopes

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Roy W. Simonson, Principal Soil Correlator, Southern States.
Correlation and inspection by M. J. Edwards, Soil Correlator.
Soils surveyed 1941-44 by T. E. Beesley, in Charge, Robert Wildermuth and S. R. Bacon, U. S. Department of Agriculture, and B. L. Matzek, W. E. Cartwright, J. A. Elder, and W. C. Sams, Tennessee Agricultural Experiment Station.

Scale 1:24,000

1 ½ 0 1 2 Miles

5000 0 5000 10000 Feet

DIAGRAM
Showing Arrangement of Sheets

See Legend Sheet for Alphabetical Legend, Color Grouping Legend, and Conventional Signs

BEECH BOTTOMS · RANKIN · PARROTTSVILLE · CLEVELAND · NEWPORT · NEDDY MOUNTAIN · HOUSTON VALLEY · CANEY BRANCH · HARTFORD · GRASSY FORK · LEMON CAMP

Map compiled and drafted for the Cartographic Division, Soil Conservation Service, by the Maps and Surveys Branch, Tennessee Valley Authority, from TVA and USGS topographic quadrangles.
Polyconic projection, 1927 North American datum.
10 000 foot grid based on Tennessee rectangular coordinate system.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP

COCKE COUNTY-TENNESSEE

CHAVIS SCHOOL SHEET

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

2 780 000 FEET — 2 810 000 FEET
83°22'30" — 20' — 17'30" — 83°15'00"
35°52'30" — 550 000 FEET

Rich Mountain
Bogard School
Church of God
Bailey Branch
Short Mountain
Pleasant Valley Church
Middle Creek
Holder Grove Church
Power Line
Chavis School
Bibee Ridge
Laurel Spring Church
Webb Springs School
Buckeye Creek
Lead Creek
Greenbriar Creek
Maddron Bald
Camp Creek
Indian Creek
Cole Creek
Old Black
Pinnacle
GREAT SMOKY MOUNTAINS NATIONAL PARK
COCKE CO.
SEVIER CO.
HAYWOOD CO.
TENN. — N. C.

50'
47'30"
510 000 FEET
35°45'00"

MATCH CHAVIS SCHOOL SHEET

MATCH INSET ON LEMON GAP SHEET

INSET

MATCH INSET

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Scale 1:24,000

1 — ½ — 0 — 1 — 2 Miles

5000 — 0 — 5000 — 10000 Feet

DIAGRAM
Showing Arrangement of Sheets

See Legend Sheet for Alphabetical Legend, Color Grouping Legend, and Conventional Signs

BEECH BOTTOMS · RANKIN · PARROTTS VALLEY · CLEVENGER · NEWPORT · NEEDY MOUNTAIN · HOUSTON VALLEY · CHAVIS SCHOOL · HARTFORD · GRASSY CREEK · LEMON GAP

Map compiled and drafted for the Cartographic Division, Soil Conservation Service, by the Maps and Surveys Branch, Tennessee Valley Authority, from TVA and USGS topographic quadrangles.
Polyconic projection, 1927 North American datum.
10 000 foot grid based on Tennessee rectangular coordinate system.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP

COCKE COUNTY-TENNESSEE

CLEVENGER SHEET

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

MATCH INSET

MATCH RANKIN SHEET

MATCH CLEVENGER SHEET

INSET

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Scale 1:24,000

1 0 1 2 Miles

5000 0 5000 10000 Feet

DIAGRAM
Showing Arrangement of Sheets

See Legend Sheet for Alphabetical Legend, Color Grouping Legend, and Conventional Signs

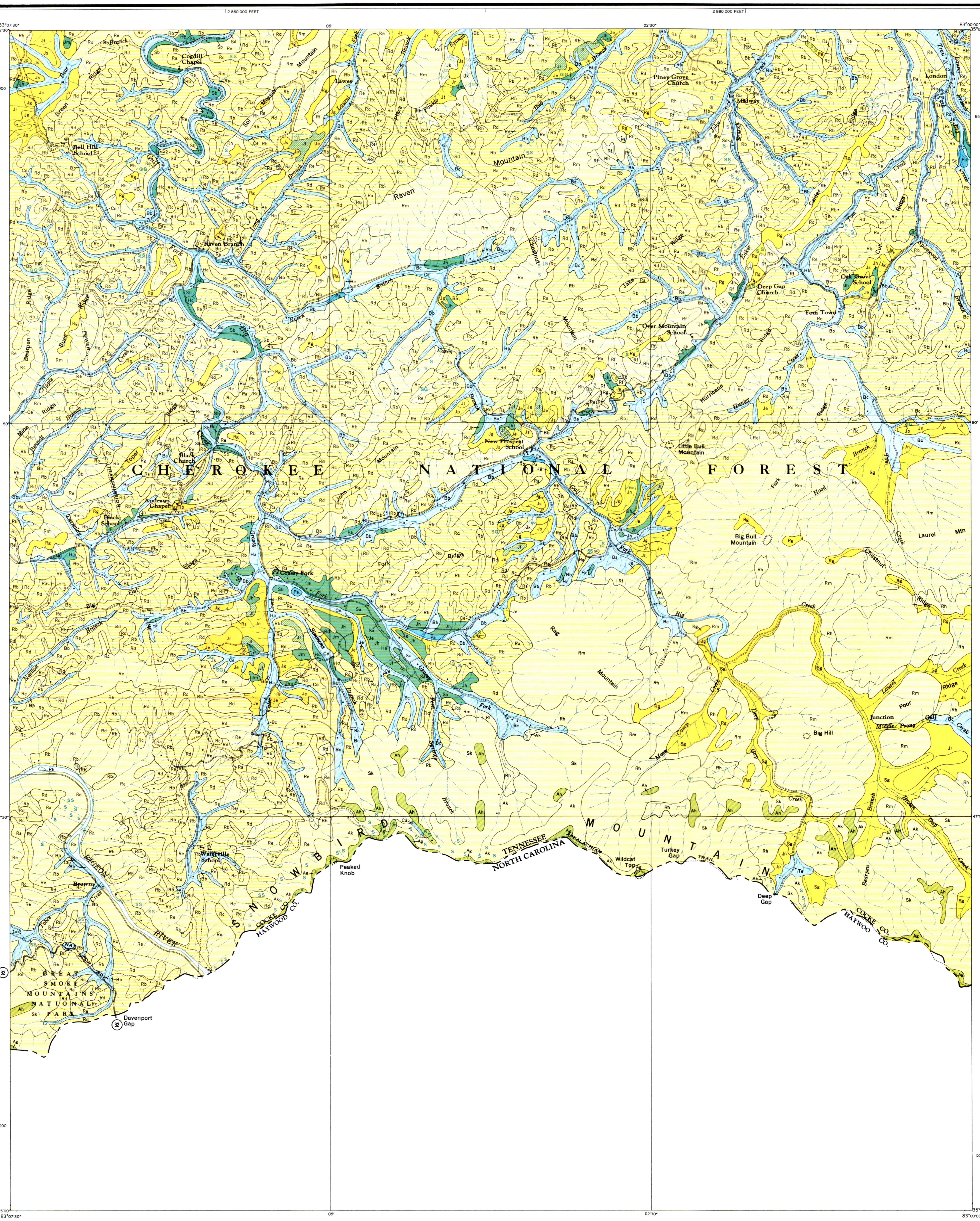
BEECH BOTTOMS · RANKIN · PARROTTSVILLE · CLEVENGER · NEWPORT · NEDDY MOUNTAIN · HOUSTON VALLEY · DAVIS BRIDGE · HARTFORD · GRASSY FORK · LEMON GAP

Map compiled and drafted for the Cartographic Division, Soil Conservation Service, by the Maps and Surveys Branch, Tennessee Valley Authority, from TVA and USGS topographic quadrangles.
Polyconic projection, 1927 North American datum.
10 000 foot grid based on Tennessee rectangular coordinate system.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
COCKE COUNTY-TENNESSEE
GRASSY FORK SHEET

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY



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1 ½ 0 1 2 Miles
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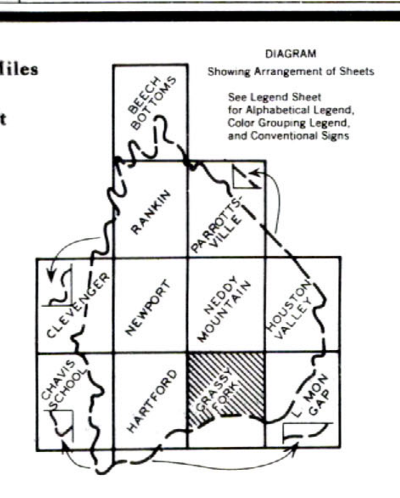

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP

COCKE COUNTY-TENNESSEE

HARTFORD SHEET

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

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Scale 1:24,000

1 0 1 2 Miles

5000 0 5000 10000 Feet

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
COCKE COUNTY-TENNESSEE
HOUSTON VALLEY SHEET

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

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Scale 1:24,000

1 0 1 2 Miles

5000 0 5000 10000 Feet

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

LEGEND SHEET
COCKE COUNTY
TENNESSEE

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

LEGEND

Aa	Allen fine sandy loam, eroded hilly phase
Ab	Allen fine sandy loam, eroded rolling phase
Ac	Allen fine sandy loam, hilly phase
Ad	Allen fine sandy loam, rolling phase
Ae	Allen stony fine sandy loam, eroded hilly phase
Af	Altavista loam
Ag	Ashe loam, hilly dark-colored phase
Ah	Ashe loam, hilly phase
Ak	Ashe loam, steep phase
Al	Augusta silt loam
Ba	Barbourville fine sandy loam
Bb	Barbourville silt loam
Bc	Barbourville stony fine sandy loam
Bd	Buncombe loamy fine sand
Ca	Camp silt loam
Cb	Chewacla fine sandy loam
Cc	Congaree fine sandy loam
Cd	Congaree loam
Ce	Cotaco fine sandy loam
Cf	Cumberland silty clay loam, eroded undulating phase
D	Dandridge and Litz shaly silt loams, eroded hilly phases
Da	Dandridge and Litz shaly silt loams, eroded rolling phases
Db	Dandridge and Litz shaly silt loams, eroded steep phases
Dc	Dandridge and Litz silt loams, hilly phases
Dd	Dandridge and Litz silt loams, rolling phases
De	Dandridge and Litz silt loams, steep phases
Df	Dandridge and Litz silt loams, very steep phases
Dg	Dandridge shaly silt loam, eroded hilly phase
Dh	Dandridge shaly silt loam, eroded rolling phase
Di	Dandridge shaly silt loam, eroded steep phase
Dj	Dandridge silt loam, hilly phase
Dk	Dandridge silt loam, rolling phase
Dl	Dandridge silt loam, steep phase
Dm	Dandridge silt loam, very steep phase
Dn	Dewey silt loam, hilly phase
Do	Dewey silty clay loam, eroded hilly phase
Dp	Dewey silty clay loam, eroded rolling phase
Dq	Dewey silty clay loam, eroded steep phase
Dr	Dunmore silt loam, hilly phase
Ds	Dunmore silt loam, rolling phase
Dt	Dunmore silt loam, steep phase
Du	Dunmore silty clay, severely eroded hilly phase
Dv	Dunmore silty clay, severely eroded rolling phase
Dw	Dunmore silty clay, severely eroded steep phase
Dx	Dunmore silty clay loam, eroded hilly phase
Dy	Dunmore silty clay loam, eroded rolling phase
Dz	Dunmore silty clay loam, eroded steep phase
Ea	Emory silt loam
Ga	Greendale silt loam
Gb	Groseclose silt loam, hilly phase
Gc	Groseclose silt loam, rolling phase
Gd	Groseclose silty clay loam, eroded hilly phase
Ge	Groseclose silty clay loam, eroded rolling phase
Gf	Gullied land (Dandridge soil material)
Gg	Gullied land (Dunmore soil material)
Ha	Hamblen fine sandy loam
Hb	Hamblen silt loam
Hc	Hayter silt loam, eroded rolling phase
Hd	Holston clay loam, severely eroded hilly phase
He	Holston clay loam, severely eroded rolling phase
Hf	Holston cobbly loam, eroded hilly phase
Hg	Holston cobbly loam, eroded rolling phase
Hh	Holston cobbly loam, hilly phase
Hk	Holston cobbly loam, rolling phase
Hl	Holston cobbly loam, undulating phase
Hm	Holston loam, eroded hilly phase
Hn	Holston loam, eroded rolling phase
Ho	Holston loam, undulating phase
Ja	Jefferson-Dunmore complex, eroded hilly phases
Jb	Jefferson-Dunmore complex, hilly phases
Jc	Jefferson-Dunmore complex, severely eroded hilly phases
Jd	Jefferson loam, eroded rolling phase
Je	Jefferson stony sandy clay loam, severely eroded hilly phase
Jf	Jefferson stony sandy clay loam, severely eroded rolling phase
Jg	Jefferson stony sandy loam, eroded hilly phase
Jh	Jefferson stony sandy loam, eroded rolling phase
Jk	Jefferson stony sandy loam, eroded steep phase
Jl	Jefferson stony sandy loam, hilly phase
Jm	Jefferson stony sandy loam, rolling phase
Jn	Jefferson very stony sandy loam, eroded hilly phase
Jo	Jefferson very stony sandy loam, eroded rolling phase
Jp	Jefferson very stony sandy loam, eroded steep phase
Jr	Jefferson very stony sandy loam, hilly phase
Js	Jefferson very stony sandy loam, rolling phase
Jt	Jefferson very stony sandy loam, steep phase
La	Leadvale silt loam, rolling phase
Lb	Leadvale silt loam, undulating phase
Lc	Lindside silt loam
Ld	Litz shaly silt loam, eroded hilly phase
Le	Litz shaly silt loam, eroded rolling phase
Lf	Litz shaly silt loam, steep phase
Ma	Monongahela silt loam
Mb	Monongahela silt loam, eroded phase
Na	Nolichucky clay loam, severely eroded hilly phase
Nb	Nolichucky clay loam, severely eroded rolling phase
Nc	Nolichucky cobbly loam, eroded hilly phase
Nd	Nolichucky cobbly loam, eroded rolling phase
Ne	Nolichucky cobbly loam, hilly phase
Nf	Nolichucky cobbly loam, rolling phase
Ng	Nolichucky loam, eroded hilly phase
Nh	Nolichucky loam, eroded rolling phase
Nk	Nolichucky loam, hilly phase
Nl	Nolichucky loam, undulating phase
Oa	Ooltewah silt loam
Pa	Prader silt loam
Ra	Ramsey shaly silt loam, eroded hilly phase
Rb	Ramsey shaly silt loam, eroded steep phase
Rc	Ramsey shaly silt loam, hilly phase
Rd	Ramsey shaly silt loam, steep phase
Re	Ramsey shaly silt loam, very steep phase
Rf	Ramsey stony fine sandy loam, eroded steep phase
Rg	Ramsey stony fine sandy loam, hilly phase
Rh	Ramsey stony fine sandy loam, steep phase
Rk	Riverwash
Rl	Rock land (limestone)
Rm	Rough mountainous land (Ramsey soil material)
Sa	Sequatchie cobbly fine sandy loam
Sb	Sequatchie fine sandy loam
Sc	Staser cobbly fine sandy loam
Sd	Staser fine sandy loam
Se	Staser silt loam
Sf	State loam
Sg	Stony colluvium (Jefferson soil material)
Sh	Stony hilly land (Dunmore soil material)
Sk	Stony rough land (Ashe soil material)
Sl	Stony steep land (Dunmore soil material)
Ta	Teas shaly silty clay loam, eroded steep phase
Tb	Teas silt loam, hilly phase
Tc	Teas silt loam, steep phase
Td	Tusquitee silt loam, hilly phase
Te	Tusquitee silt loam, rolling phase
Tf	Tyler silt loam
Wa	Waynesboro clay loam, severely eroded hilly phase
Wb	Waynesboro clay loam, severely eroded rolling phase
Wc	Waynesboro cobbly loam, eroded hilly phase
Wd	Waynesboro loam, eroded hilly phase
We	Waynesboro loam, eroded rolling phase
Wf	Waynesboro loam, undulating phase
Wg	Wehadkee silt loam
Wh	Whitesburg silt loam

SOIL MANAGEMENT GROUPS
(SEE TEXT OF REPORT)

MANAGEMENT GROUP	DESCRIPTION
1	NEARLY LEVEL WELL AND IMPERFECTLY DRAINED LOAM SOILS OF THE BOTTOM LANDS
2	NEARLY LEVEL EXCESSIVELY DRAINED VERY SANDY SOILS OF THE BOTTOM LANDS
3	NEARLY LEVEL, UNDULATING, AND ROLLING YOUNG SOILS OF THE COLLUVIAL LANDS
4	UNDULATING DEEP FRIABLE RED AND BROWN SOILS
5	UNDULATING FRIABLE YELLOW SOILS
6	ROLLING FIRM RED TO REDDISH-YELLOW SOILS
7	ROLLING NONSTONY YELLOW SOILS
8	UNDULATING AND ROLLING STONY FRIABLE REDDISH-YELLOW AND YELLOW SOILS ON STREAM TERRACES AND COLLUVIAL SLOPES
9	ROLLING DEEP AND MODERATELY DEEP SEVERELY ERODED SOILS
10	HILLY NONSTONY MODERATELY FERTILE SOILS WITH FRIABLE SURFACE SOILS AND MODERATE DEPTH TO BEDROCK
11	HILLY SOILS OF LOW FERTILITY WITH FRIABLE SURFACE SOILS AND MODERATE DEPTH TO BEDROCK
12	ROLLING SOILS SHALLOW TO SHALE BEDROCK
13	HILLY PERMEABLE LOAM SOILS ON HIGH MOUNTAINS
14	MODERATELY FERTILE STEEP AND STONY HILLY SOILS NOT WELL SUITED TO CROPS REQUIRING TILLAGE
15	HILLY SOILS WITH COMPACT SURFACE SOILS
16	STONY SANDY SOILS OF LOW NATURAL FERTILITY NOT CONSIDERED WELL SUITED TO CROPS BUT SUITABLE FOR PASTURE
17	HILLY AND STEEP SOILS SHALLOW TO SHALE OR SLATE
18	NEARLY LEVEL POORLY DRAINED GRAY SOILS
19	SOILS POORLY SUITED TO EITHER CROPS OR PASTURE BUT ADAPTED TO FORESTRY

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort

Secondary roads, Trails

Railroads

Bridges, Ferry

Railroad crossings

Ford, Dam, Sawmill, Windmill

Boundary lines

School, Church, Creamery, Cemeteries

Boundary lines

Triangulation station, Boundary monument, Oil or Gas wells

U. S. Township and Section lines, Recovered corners

Forest fire station, Airway beacon, Oil or Gas tanks

Transmission line, Oil or Gas pipe line

Mine or Quarry, Gravel pit, Rock outcrop, Made land

Soil boundaries; Stony, Gravelly, and Cherty areas

RELIEF
(Printed in brown or black)

Contours, Depression contours

Prominent hills or Mountain peaks

Sand, Wash, Sand dunes

Bluff, Escarpment, Mine dumps

DRAINAGE
(Printed in blue)

Streams, Springs, Wells, Flowing wells

Lakes, Ponds, Intermittent lakes

Unsurveyed and Intermittent streams

Water pipe lines, Canals, Ditches, Flumes

Swamp, Salt marsh

Submerged marsh, Tidal flats

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier dates.

SPECIAL SYMBOLS

U Uneroded areas

ACCELERATED EROSION

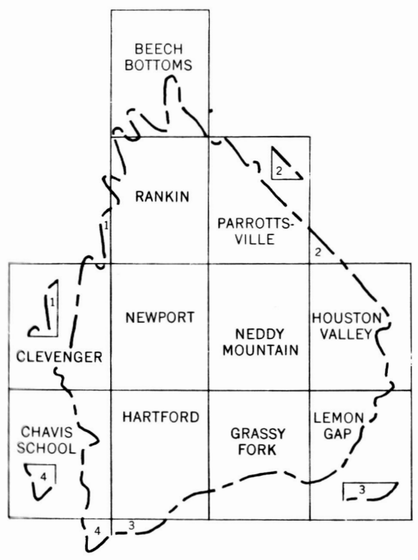
- S Moderate sheet erosion
- SS Severe sheet erosion
- G Moderate gully erosion
- GG Severe gully erosion
- SG Moderate sheet and gully erosion
- Gully

SINK HOLES AND DEPRESSIONS

- Easy to cultivate across
- Difficult to cultivate across
- Containing water most or all of the time

NOTE: The area inundated by the Douglas Reservoir is shown by blue cross hatching.

DIAGRAM
Showing arrangement of sheets



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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP

COCKE COUNTY-TENNESSEE

LEMON GAP SHEET

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

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1 0 1 2 Miles

5000 0 5000 10000 Feet

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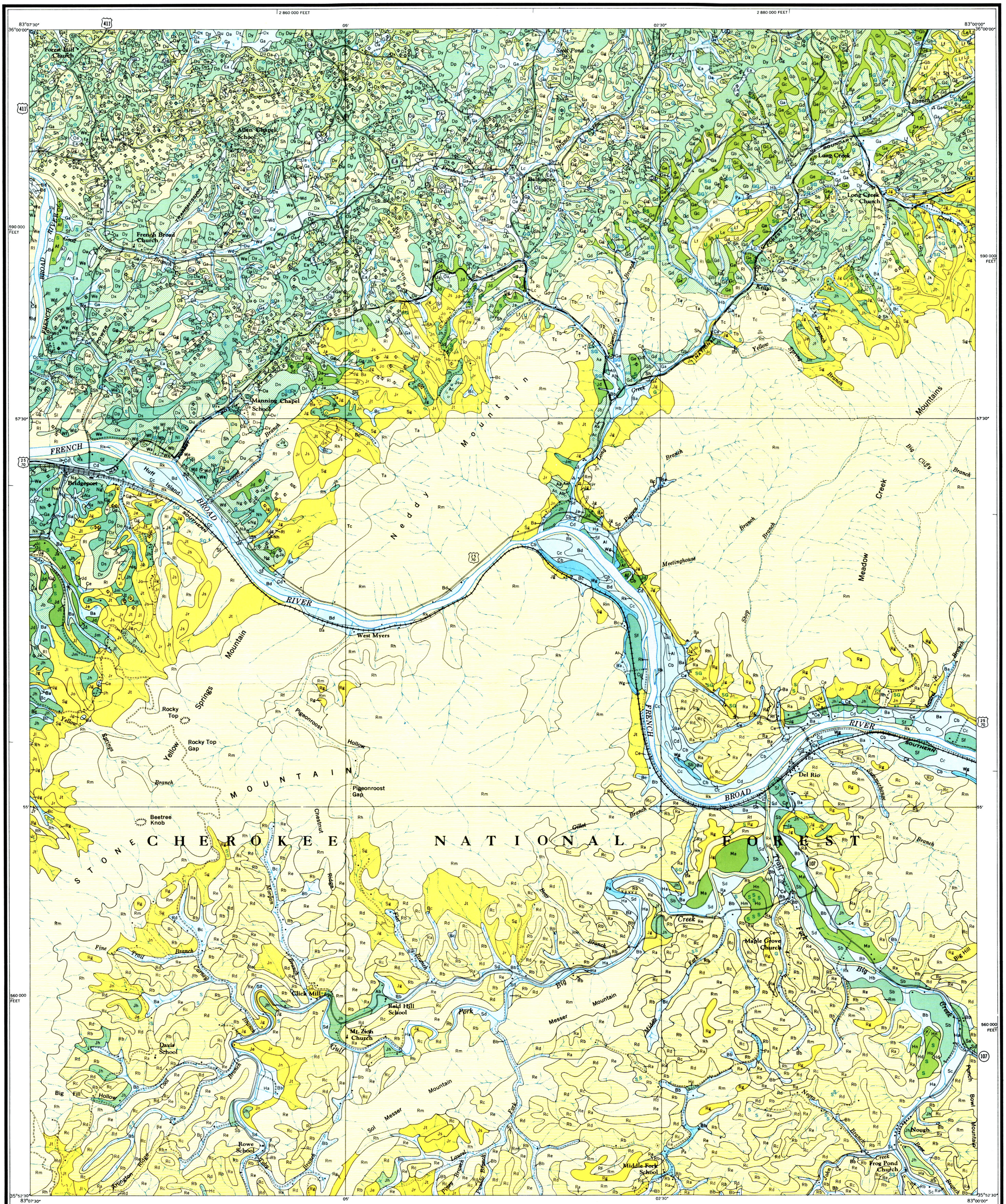
SOIL CONSERVATION SERVICE

SOIL MAP
COCKE COUNTY-TENNESSEE
NEDDY MOUNTAIN SHEET

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY



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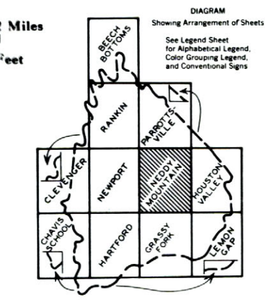

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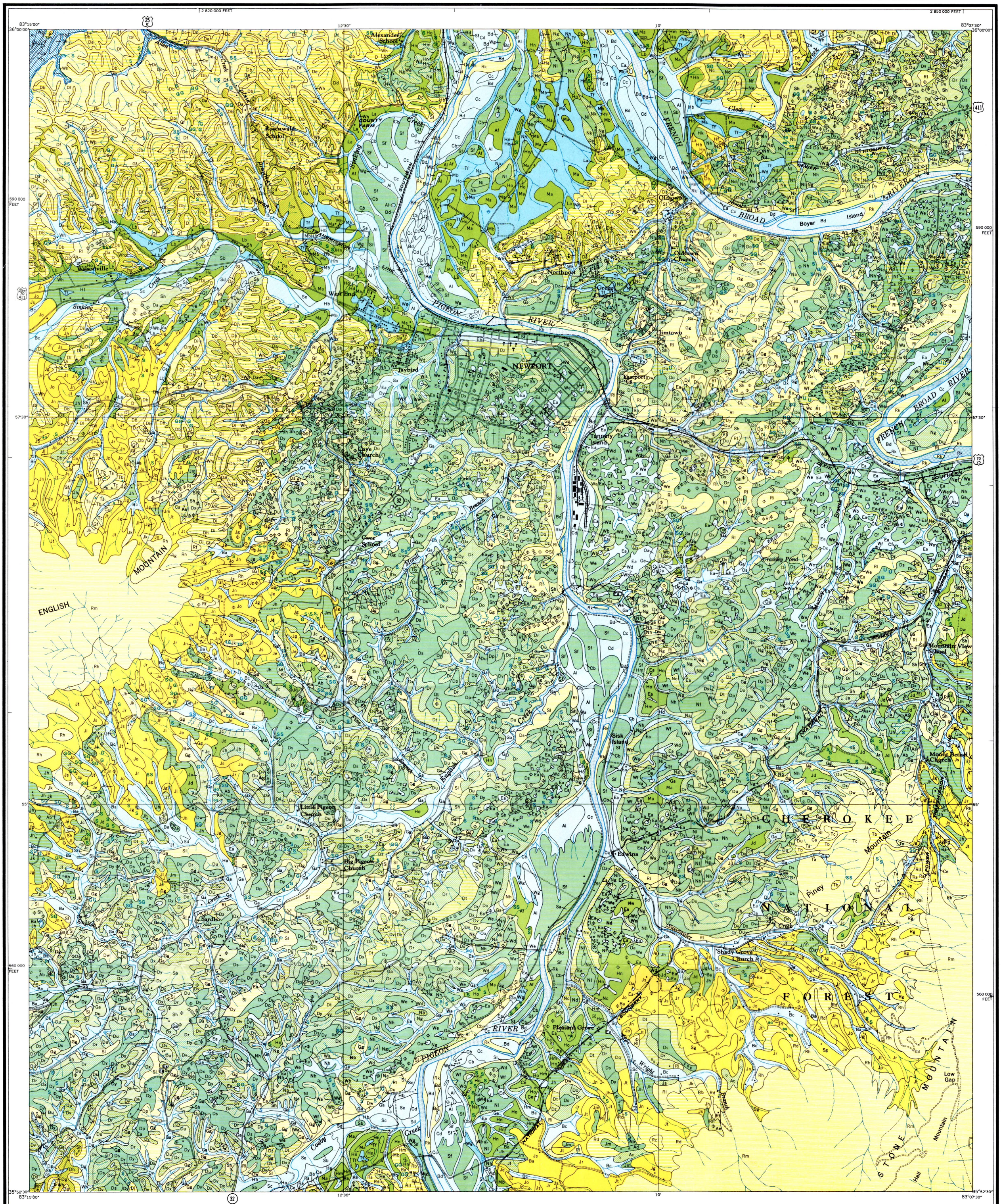
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
COCKE COUNTY-TENNESSEE
NEWPORT SHEET

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY



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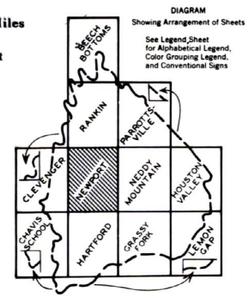

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP

COCKE COUNTY-TENNESSEE

PARROTTSVILLE QUADRANGLE

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

2 850 000 FEET — 2 880 000 FEET

83°07'30" — 05' — 02'30" — 83°00'00"

36°07'30" — 36°07'30"

640 000 FEET — 640 000 FEET

610 000 FEET

600 000 FEET

36°00'00" — 36°00'00"

83°07'30" — 05' — 02'30" — 83°00'00"

2 860 000 FEET — 2 880 000 FEET

GREENE CO. — COCKE CO.

NOLICHUCKY RIVER

Johnson Branch — Bear Creek — Holt School — Meadmore Branch — Oven Creek — Goodwater Branch — Bruner Grove — Ziott Hill School — Palmer Creek — Houston Chapel — Natural Bridge — Horned Chapel — Goodwater School — Oven Creek Church — Easterly School — Mount Bethany Church — Luther Memorial Church — Ottinger — Ottinger School — Union Hill Church — Salem — Salem Church — Clay Creek — Parrottsville — JOHN SEVIER HIGHWAY — TRANSMISSION LINE — (APPROXIMATE BOUNDARY) — Dawson Valley Church — 411

INSET

MATCH PARROTTSVILLE SHEET

Oak Hill — Rabbit Hill School — Meadow Creek

MATCH HOUSTON VALLEY SHEET

2 890 000 FEET

MATCH INSET

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Scale 1:24,000

1 — ½ — 0 — 1 — 2 Miles

5000 — 0 — 5000 — 10000 Feet

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SOIL CONSERVATION SERVICE

SOIL MAP
COCKE COUNTY-TENNESSEE
RANKIN QUADRANGLE

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

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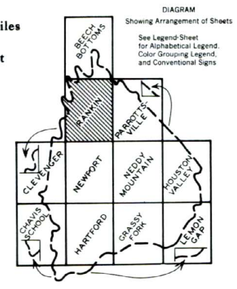
See Legend-Sheet for Alphabetical Legend, Color Grouping Legend, and Conventional Signs



Map compiled and drafted for the Cartographic Division, Soil Conservation Service, by the Maps and Surveys Branch, Tennessee Valley Authority, from TVA and USGS topographic quadrangles.
Polyconic projection, 1927 North American datum.
10 000 foot grid based on Tennessee rectangular coordinate system.

Soil	Map symbol	Slope range	Internal drainage	Surface soil color [1]	Subsoil		Depth [2]	Nature of parent rock or parent material	Management group [3]
					Color	Consistence			
		Percent					*Feet*		
Allen fine sandy loam: Rolling phase	AD	5–12	Moderate	Yellowish brown	Yellowish red	Firm but friable	3 –10	Old alluvium or colluvium originating chiefly from sandstone and quartzite.	6
Eroded rolling phase	AB	5–12	do	Reddish yellow	do	do	2½ –10	do	6
Hilly phase	AC	12–25	do	Yellowish brown	do	do	2 – 8	do	10
Eroded hilly phase	AA	12–25	do	Reddish yellow	do	do	2 – 8	do	10
Allen stony fine sandy loam, eroded hilly phase	AR	12–25	do	do	do	do	2 – 8	do	14
Altavista loam	AF	2–10	Somewhat retarded	Pale yellow	Yellow	Moderately firm but friable	3 –15	Old alluvium originating from granite and gneiss.	5
Ashe loam: Steep phase	AK	25–60	Moderate	Dark yellowish brown, pale brown or grayish yellow.	Yellow or yellowish brown	Very friable	½ – 2	Gneiss and granite	19
Hilly phase	AH	12–25	do	do	do	do	1 – 3	do	13
Hilly dark-colored phase	AG	12–25	do	Dark brown	Yellowish brown	do	1½ – 3½	do	13
Augusta silt loam	AL	0– 2	Slow	Dark yellowish brown	do	Firm but friable	3 –15+	Old alluvium originating from gneiss and granite.	3
Barbourville fine sandy loam	BA	1– 7	Moderate	Pale brown	Pale brown to yellowish brown	Friable	2 – 6	Recent alluvium originating from sandstone and quartzite.	3
Barbourville silt loam	BB	1– 9	do	Yellowish brown to dark yellowish brown.	Yellowish brown	do	3 – 6	Recent alluvium originating from slate and shale.	3
Barbourville stony fine sandy loam	BC	1– 7	do	Pale brown	Pale brown to light yellowish brown.	Loose	3 – 6	Recent alluvium originating from sandstone and quartzite.	3
Buncombe loamy fine sand	BD	1– 3	Very rapid	Grayish brown to dark grayish brown.	Light yellowish brown to pale yellow.	do	5 –15	Recent alluvium originating from gneiss and granite.	2
Camp silt loam	CA	2– 7	Moderate	Reddish brown	Weak reddish brown	Firm	3 – 7	Recent alluvium originating from shale, in parts calcareous.	3
Chewacla fine sandy loam	CB	0– 2	Slow	Dark brown	Mottled brown, yellow, and gray	Moderately firm but friable	5 –15	Recent alluvium originating from gneiss and granite.	1
Congaree fine sandy loam	CC	0– 2	Rapid	Brown	Yellowish brown	Very friable	5 –15	do	1
Congaree loam	CD	0– 2	Moderate	Dark brown	do	do	5 –15	do	1
Cotaco fine sandy loam	CE	0– 3	Slow	Light brownish gray	Mottled light gray, pale yellow, and brown.	Friable	2 – 6	Recent alluvium originating from sandstone and quartzite.	3
Cumberland silty clay loam, eroded undulating phase	CF	2–12	Moderate	Very dark brown	Red	Firm but friable	4 –18	Old alluvium originating from limestone, sandstone, shale, and other rocks.	4
Dandridge silt loam: Steep phase	DL	25–60	do	Grayish brown or light brownish gray.	Pale yellow to gray	do	½ – 2	Calcareous shale	17
Hilly phase	DJ	12–25	do	do	do	do	½ – 2½	do	17
Rolling phase	DK	2–12	do	do	do	do	½ – 2½	do	12
Very steep phase	DM	60+	do	Grayish brown or brownish gray	do	do	½ – 1½	do	19
Dandridge shaly silt loam: Eroded steep phase	DI	25–60	do	Yellowish gray or light brownish gray.	do	do	½ – 1¼	do	17
Eroded hilly phase	DO	12–25	do	do	do	do	½ – 2	do	17
Eroded rolling phase	DH	2–12	do	do	do	do	½ – 2	do	12
Dandridge and Litz silt loams: Steep phases	DE	25–60	do	Yellowish gray	Pale yellow to brownish yellow	do	½ – 3	do	17
Hilly phases	DC	12–25	do	do	do	do	½ – 3	do	17
Rolling phases	DD	5–12	do	do	do	do	½ – 3	do	12
Very steep phases	DF	60+	do	Grayish yellow	do	do	½ – 1½	do	19
Dandridge and Litz shaly silt loams: Eroded steep phases	DN	25–60	do	Light brownish gray	do	do	½ – 2	do	17
Eroded hilly phases	D	12–25	do	do	do	do	½ – 2½	do	17
Eroded rolling phases	DA	5–12	do	Yellowish gray	do	do	½ – 2½	do	12
Dewey silty clay loam: Eroded rolling phase	DF	5–12	do	Grayish brown to yellowish red	Red	do	8 –15	High-grade limestone	6
Eroded hilly phase	DO	12–25	do	Reddish brown	do	do	5 –12	do	10
Eroded steep phase	DQ	25–60	do	do	do	do	3 –12	do	14
Dewey silt loam, hilly phase	DW	12–25	do	Brown or dark brown	do	do	6 –14	do	10
Dunmore silt loam: Rolling phase	DS	5–12	Somewhat retarded	Light yellowish brown	Reddish yellow or yellowish red	Firm, moderately compact	3 –10	Slightly clayey limestone	6
Hilly phase	DR	12–25	do	do	do	do	2 – 8	do	10
Steep phase	DT	25–60	do	Pale brown	do	do	1½ – 7	do	14
Dunmore silty clay loam: Eroded rolling phase	DY	5–12	do	Yellowish brown	do	do	2½ – 9	do	6
Eroded hilly phase	DX	12–25	do	do	do	do	1½ – 7	do	10
Eroded steep phase	DZ	25–60	do	do	do	do	1 – 6	do	14
Dunmore silty clay: Severely eroded rolling phase	DV	5–12	do	Yellowish red	do	do	2 – 8	do	9
Severely eroded hilly phase	DU	12–25	do	do	do	do	1 – 6	do	15
Severely eroded steep phase	DW	25–60	do	Reddish yellow or yellowish red	do	do	1½ – 5	do	19
Emory silt loam	EA	0–5	Moderate	Brown to dark brown	Brown to red	Friable	3 –10	Recent alluvium originating from high-grade limestone.	3
Greendale silt loam	GA	1–9	do	Light yellowish brown	Yellowish brown	Firm but friable	3 –10	Recent alluvium originating from cherty limestone.	3
Groseclose silt loam: Rolling phase	GC	5–12	Somewhat retarded	Pale brown or light gray	Yellow	Compact	2½ – 8	Shaly limestone	7
Hilly phase	GB	12–25	do	Pale brown	do	do	1½ – 6	do	11
Groseclose silty clay loam: Eroded rolling phase	GE	5–12	do	Grayish yellow or yellow	do	do	2 – 7	do	7
Eroded hilly phase	GD	12–25	do	do	do	do	1 – 5	do	11
Gullied land: Dandridge soil material	GF	12–50	do	Pale yellow to brownish yellow		Firm but friable	0 – 2½	Calcareous shale	19
Dunmore soil material	GG	12–45	do	Reddish yellow		Firm, moderately compact	½ – 3	Slightly clayey limestone	19
Hamblen silt loam	HB	0–2	Slow	Light brown	Mottled yellow, brown, and gray	Friable	3 –10	Recent alluvium originating chiefly from shale and slate.	1
Hamblen fine sandy loam	HA	0–2	do	Pale brown	do	do	3 –10	Recent alluvium originating chiefly from sandy rocks.	1
Hayter silt loam, eroded rolling phase	HC	3–10	Moderate	Yellowish brown	Yellowish brown	Firm but friable	2 – 8	Old alluvium or colluvium originating chiefly from sandy rocks or limestone.	6
Holston loam: Undulating phase	HO	1–5	do	Pale yellow	Brownish yellow	do	3 –15	Old alluvium originating from shale, slate, sandy rocks, and limestone.	5
Eroded rolling phase	HN	5–12	do	Brownish yellow	do	do	2½ –12	do	7
Eroded hilly phase	HM	12–25	do	do	do	do	1½ –10	do	11
Holston clay loam: Severely eroded rolling phase	HH	5–12	do	do	Yellow mottled with gray and brown.	do	1½ –10	do	9
Severely eroded hilly phase	HD	12–25	do	do	Brownish yellow	do	1 – 8	do	15
Holston cobbly loam: Undulating phase	HL	2–5	do	Pale yellow	do	do	3 –15+	do	8
Rolling phase	HK	5–12	do	do	do	do	2½ –12	do	8
Eroded rolling phase	HG	5–12	do	Brownish yellow	do	do	2½ –12	do	8
Hilly phase	HH	12–25	do	Pale yellow	do	do	1 –10	do	16
Eroded hilly phase	HF	12–25	do	Brownish yellow	do	do	1 –10	do	16
Jefferson loam, eroded rolling phase	JD	5–12	do	Pale yellow	Yellow or brownish yellow	do	2½ – 9	Old alluvium or colluvium originating from sandstone, quartzite, and shale.	7
Jefferson stony sandy loam: Rolling phase	JM	5–12	do	do	Yellowish brown	do	3 –15+	do	8
Eroded rolling phase	JH	5–12	do	Yellowish brown	do	do	2½ –12+	do	8
Hilly phase	JL	12–25	do	Pale yellow	do	do	2 –12+	do	16
Eroded hilly phase	JG	12–25	do	Yellowish brown	do	do	1½ –12+	do	16
Eroded steep phase	JK	25–50	do	do	do	do	1 – 8	do	19
Jefferson stony sandy clay loam: Severely eroded rolling phase	JF	5–12	do	do	do	do	2 –10+	do	9
Severely eroded hilly phase	JE	12–25	do	do	do	do	1 –10	do	16
Jefferson very stony sandy loam: Rolling phase	JS	5–12	do	Pale yellow	do	do	3 –15+	do	16
Eroded rolling phase	JO	5–12	do	Pale yellow or yellow	do	do	3 –15+	do	16
Hilly phase	JR	12–25	do	Pale yellow	do	do	2 –12+	do	16
Eroded hilly phase	JN	12–25	do	Brownish yellow	do	do	1 –10	do	16
Steep phase	JT	25–50	do	Pale yellow	do	do	1 – 8	do	16
Eroded steep phase	JP	25–50	do	Yellowish brown	do	do	1 – 8	do	16
Jefferson-Dunmore complex: Hilly phases	JB	12–25	do	Pale yellow	Brownish yellow and yellowish red	do	2 – 9	Old alluvium and residuum from slightly clayey limestone.	11
Eroded hilly phases	JA	12–25	do	Yellow	Yellowish brown to yellowish red	do	2 – 9	do	11
Severely eroded hilly phases	JC	12–25	Somewhat retarded	Yellowish brown and reddish yellow.	do	do	2 – 7	do	15
Leadvale silt loam: Undulating phase	LB	2– 5	Slow	Pale yellow	Yellow grading to mottled	Firm	3 –10	Old alluvium chiefly from shale and slate	5
Rolling phase	LA	5–12	do	do	do	do	2 – 7	do	5
Lindside silt loam	LC	0– 2	do	Grayish brown	Mottled gray and light yellowish brown.	Friable	3 –10	Recent alluvium originating chiefly from limestone.	1
Litz shaly silt loam: Steep phase	LF	25–60	Moderate	Grayish yellow	Light yellowish brown	Firm but friable	0 – 1	Leached calcareous shale or acid shale with a few limestone lenses.	17
Eroded hilly phase	LD	12–25	do	do	do	do	0 – 1½	do	17
Eroded rolling phase	LE	5–12	do	do	do	do	½ – 1½	do	12
Monongahela silt loam	MA	1– 5	Slow	Pale brown to white	Pale yellow grading to mottled	Friable grading to compact	3 –10	Old alluvium originating from quartzite, shale, slate, sandstone, and limestone.	5
Eroded phase	MB	2– 5	do	Pale yellow	do	do	2½ –10	do	5
Nolichucky loam: Undulating phase	NL	2– 5	Moderate	Pale brown	Reddish yellow	Firm but friable	3 –15	do	4
Eroded rolling phase	NH	5–12	do	do	do	do	2 –12	do	6
Hilly phase	NK	12–25	do	do	do	do	1¼ –10	do	11
Eroded hilly phase	NG	12–25	do	do	do	do	1½ –10	do	11
Nolichucky clay loam: Severely eroded rolling phase	NB	5–12	do	Reddish yellow	do	do	1½ –10	do	9
Severely eroded hilly phase	NA	12–25	do	do	do	do	1 – 8	do	15
Nolichucky cobbly loam: Rolling phase	NP	5–12	do	Pale brown	do	do	2¼ –10	do	8
Eroded rolling phase	ND	5–12	do	do	do	do	2¼ –10	do	8
Hilly phase	NE	12–25	do	do	do	do	1½ –10	do	14
Eroded hilly phase	NC	12–25	do	do	do	do	1½ –10	do	14
Coltewah silt loam	OA	0– 2	Slow	Grayish brown	Mottled gray, yellow, and brown	Friable	8 –20	Recent alluvium originating from limestone.	3
Prader silt loam	PA	0– 2	Very slow	Gray to light gray	Gray mottled with yellow and dark brown.	Firm, compact	4 –10	Recent alluvium originating chiefly from slate and calcareous shale.	18
Ramsey shaly silt loam: Steep phase	RD	25–60	Moderate	Dark grayish brown	Brownish yellow	Friable	½ – 2	Slate	17
Eroded steep phase	RB	25–60	do	Brownish yellow	do	do	½ – 2	do	17
Very steep phase	RE	60+	do	Dark grayish brown	do	do	½ – 1½	do	19
Hilly phase	RC	12–25	do	do	do	do	1 – 2½	do	17
Eroded hilly phase	RA	12–25	do	Brownish yellow	do	do	1 – 2	do	17
Ramsey stony fine sandy loam: Steep phase	RH	25–60	do	Light yellowish brown	Pale yellow	do	½ – 3	Quartzite and sandstone	19
Eroded steep phase	RF	25–60	Rapid	do	do	do	½ – 2½	do	19
Hilly phase	RG	12–25	Moderate	do	do	do	1 – 3	do	16
Riverwash	RK	1– 5	Very Rapid	White or light gray	White or light gray	Very loose	3 –15+	Recent alluvium originating chiefly from quartzite, granite, and sandstone.	19
Rock land (limestone)	RL	5–40+						Limestone	19
Rough mountainous land (Ramsey soil material)	RM	12–60+					0 – 1½	Quartzite, conglomerate, and sandstone	19
Sequatchie fine sandy loam	SB	1– 5	Rapid	Dark grayish brown	Yellowish brown	Friable	5 –10	Old alluvium originating from quartzite, sandstone, shale, and limestone.	4
Sequatchie cobbly fine sandy loam	SA	1– 5	do	do	do	do	5 –10	do	8
Staser fine sandy loam	SD	0– 2	do	Brown	do	do	3 –10	Recent general alluvium originating from quartzite, sandstone, and other rocks.	1
Staser cobbly fine sandy loam	SC	0– 2	do	do	do	do	3 –10	do	1
Staser silt loam	SE	0– 2	Moderate	do	do	do	3 –10	Recent general alluvium originating chiefly from shale and slate.	1
State loam	SF	0– 2	do	Dark grayish brown	do	do	5 –10	Old general alluvium originating from granite and gneiss.	4
Stony colluvium (Jefferson soil material)	SO	5–30	Rapid	Brownish yellow	Brownish yellow	do	2 –10	Recent local alluvium originating from quartzite, conglomerate, and sandstone.	16
Stony hilly land (Dunmore soil material)	SH	12–25	Somewhat retarded	Grayish brown	Reddish brown	Firm, compact	0 – 3	Slightly clayey limestone	15
Stony rough land (Ashe soil material)	SK	30–60+	Rapid	do	Yellow	Friable	0 – 2	Granite and gneiss	19
Stony steep land (Dunmore soil material)	SL	25–60	Somewhat retarded	do	Reddish brown	Firm, compact	0 – 1½	Slightly clayey limestone	19
Teas silt loam: Steep phase	TC	25–60+	do	Light reddish brown	do	Firm	0 – 1½	Reddish shale, part calcareous	19
Hilly phase	TB	12–25	do	do	do	do	½ – 2	do	17
Teas shaly silty clay loam, eroded steep phase	TA	25–60+	do	do	do	do	½ – 1½	do	19
Tusquitee silt loam: Rolling phase	TE	2–12	Moderate	Dark brown	Dark yellowish brown	Firm but friable	2 –10	Chiefly young alluvium originating from granite and gneiss.	3
Hilly phase	TD	12–25	do	do	do	do	1½ – 8	do	10
Tyler silt loam	TF	0– 2	Very slow	Light brownish gray	Gray mottled with yellow	Friable grading to very compact	5 –10	Old alluvium originating from shale, slate, quartzite, sandstone, and limestone.	18
Waynesboro loam: Undulating phase	WF	2– 5	Moderate	Brown	Yellowish red	Firm but friable	5 –15	do	4
Eroded rolling phase	WE	5–12	do	Reddish brown	do	do	2½ –12	do	6
Eroded hilly phase	WD	12–25	do	do	do	do	1½ –10	do	10
Waynesboro clay loam: Severely eroded rolling phase	WB	5–12	Somewhat retarded	Yellowish red	do	do	1½ –10	do	9
Severely eroded hilly phase	WA	12–25	do	do	do	do	1 – 8	do	15
Waynesboro cobbly loam, eroded hilly phase	WC	12–25	Moderate	Reddish brown	do	do	1½ –10	do	14
Wehadkee silt loam	WG	0– 2	Very slow	Light brownish gray	Gray mottled with yellow and brown.	Compact, tight	4 –15	Recent alluvium originating from granite and gneiss.	18
Whitesburg silt loam	WH	0– 5	Slow	Brown	Yellowish brown mottled with gray and brown.	Friable	2 – 6	Recent alluvium originating from calcareous shale.	3

[1] Under moderately moist conditions.

[2] Depth to bedrock or to distinctly different material, as a bed of gravel.

[3] For descriptions and discussions of these groups, see the section on Use and Management of Soils, p. 97. These groups are represented on the detailed soil map by distinguishing colors.